

**New zeal for new New Zealand earthworms (Acanthodrilidae, Octochaetidae,  
Megascolecidae, Lumbricidae: Oligochaeta: Annelida)**

by

Robert J. Blakemore ([rob.blakemore@gmail.com](mailto:rob.blakemore@gmail.com)) VermEcology, Japan)  
C/- National Museum of Nature and Science Tokyo, Japan

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**Abstract**

New species are added to the ca. 200 currently known from New Zealand. Five new taxa are in Acanthodrilidae; four in Octochaetidae and four in Megascolecidae. Monotypic *Eudinodriloides* Lee, 1959 is newly combined as *syn. nov.* under *Decachaetus* Lee, 1959 with its type-species, *Decachaetus forsteri* (Lee, 1959), as *comb. nov.*. All new taxa are endemics apparently with highly restricted ranges; however, little is yet known of their distribution, ecology nor conservation status. mtDNA COI barcoding is attempted – the first time New Zealand new holotypes have been so characterized – and this data is accessible on GenBank and iBOL websites. *Maoridrilus transalpinus* Lee, 1959 is redescribed based on new material. A new record of exotic lumbricid *Octolasion tyrtaeum tyrtaeum* (Savigny, 1826) along with the current new natives raises the national NZ earthworm species account to approximately 212 species from five families. Appendices provide DNA results, information on preservation methods using Propylene Glycol, and on the (re-)location of some of the late Dr Ken Lee's NZ earthworm primary types from 60 yrs ago, long thought lost. This paper demonstrates rapid publication of new taxa simultaneously with online genetic data – of itself crucial in 2010 the UN designated International Year of Biodiversity – as a means of unburdening “*Taxonomic Impediment*”.

**Introduction**

Dr Ken Lee's definitive 1959 study of New Zealand earthworms was updated and checklisted by Blakemore (2004, 2007) as initially modified by Blakemore in Lee *et al.*, (2000) that, however, was not published for 10 years (see Glasby *et al.* 2009). Because many natives had few subsequent reports, or are based on only a few specimens, approximately 77 are automatically listed as “*Threatened*” or “*Endangered*” in the Department of Conservation (DoC) threatened species list ([Ref.](#), April, 2005), and details on three of these species are given in McGuinness (2001) while 167 species qualified as

‘data deficient’ in Hitchmough *et al.* (2005). As marine studies flourish so do terrestrial surveys inexplicably languish and further work such as that conducted by Springett & Gray (1998) is urgently required to determine the true status of natives rather than mere repetition of European style research on the relatively few species of introduced lumbricids.

Whereas the enduring work by Lee (1959) listed approximately 193 species, little interest has been shown on the native earthworms for the last 60 years and main additions are of exotics: *Octolasion lacteum* (Örley, 1881) found by Martin (1977) and three others added to the NZ alien species list following extensive searches of literature by Blakemore (2002, 2004, 2007, 2008). These latter were from reports by Michaelsen (1900: 425) who listed *Pontoscolex corethrurus* from NZ – this seemingly overlooked by all subsequent authors up to the present author; Easton (1981: 53) who reported *Amyntas hupeiensis* (Michaelsen, 1895) from NZ; and Easton (1984: 118) who recorded *Amyntas gracilis* (Kinberg, 1867) and *Amyntas corticis* (Kinberg, 1867) from Raoul Id.. In addition *Perionyx excavatus* Perrier, 1872 and *Dendrobaena veneta* (Rosa, 1886) were identified by the current author in 2001 and 2002 from worm farms in NZ (Blakemore, 2002, 2004, 2007, 2008). These latter published classification checklists gave natives separate family status as per Blakemore (2000) to raise the numbers of megadrile earthworm families known from New Zealand from two to five, viz. Acanthodrilidae, Octochaetidae and Megascolecidae *sensu* Blakemore (2000), Lumbricidae and Glossoscolecidae (for *Pontoscolex*). In contrast, some current online and public presentations yet mistakenly claim just 170 species in two families from New Zealand.

Buckley *et al.* (2010) venture a phylogeny for the New Zealand earthworm fauna they call “(*Megascolecinae* and *Acanthodrilinae*)”. However their concepts of families and genera appear reversions back 50 yrs or more ago and thus confidence in taxonomic identification at species level and, hence phylogenetic conclusions, may be questioned. Moreover, cryptic taxonomic diversity claims without consideration and analysis of all synonyms under ICZN Principals of Priority and Typification may be false (see Blakemore *et al.*, 2010).

In the present work, DNA analysis of primary types – rather than for mere vouchers or coded species identifiers – is attempted and some of these data are provided

along with the species descriptions as advocated and demonstrated by Blakemore *et al.* (2010). Taxonomic identification of specimens is the first step facilitating an understanding of the Ecology of a species, its ecosystem functioning, conservation status, phylogenetic relationships, molecular characteristics etc., always based on a universal and unique identifier: its ICZN binomial Linnaean Scientific name.

Funding and other resources are sought to complete a DNA and morphology database and illustrated interactive computer guide to all New Zealand species (as per Blakemore's 2000 DELTA guide to all 230 Tasmanian earthworms), as a prerequisite for further earthworm surveys and as a foundation for recommencing ecological, pastoral, and agricultural research and soil management with renewed vigour as appreciative tribute to Lee's 'groundbreaking' work started 60 yrs earlier (see Appendix 4) to all NZ species that are here presented in a revised taxonomic checklist in Appendix 5.

## **Materials and Methods**

Specimens were sketched, dissected and described under low power microscope using the techniques and conventions noted in Blakemore (2002, 2008). Small tissue samples were taken from non-essential iterative, posterior segments ventrally for mtDNA analysis and COI barcoding (some results already submitted to GenBank – see Appendix 1). Classification follows Blakemore (2000) at family level and Blakemore (2004, 2007, 2008) at genus and species levels. Discussion is confined to Remarks after each species' description.

This work is issued in compliance with Article 8 of ICZN ([1999](#)) in order to provide a public and permanent record. According to this Article, identical versions of the current paper on simultaneously obtainable copies of a read-only CD disk are lodged in The National Library, Canberra and libraries at the Museum of Natural History, London; the Smithsonian Institution, Washington; Te Papa, Wellington, NZ; the National Museum of Nature and Science, Tokyo; Hungary National Museum, Budapest and Lake Biwa Museum, Shiga. A copy may be sent to Lincoln once promised monies owing are honoured. Further copies of the work are obtainable directly from the author and will be sent to the *Zoological Record* and to BIOSIS, UK.

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Regarding registration of types and other specimens: as of 28<sup>th</sup> December, 2010 an email request to Te Papa, Wellington ([brucem@tepapa.govt.nz](mailto:brucem@tepapa.govt.nz)) for registration requirements sent 22<sup>nd</sup> November remains unanswered. Nevertheless, labeled specimens were transferred to and deposited in the Entomology Museum of Lincoln University that is under the curatorial auspices of Mr John Marris ([John.Marris@lincoln.ac.nz](mailto:John.Marris@lincoln.ac.nz)). Explicit fixation of name-bearing types under ICZN (1999: Art. 16.4) is qualified under Article 16.4.2 in that extant holotype or syntype specimens, require a statement of intent that they will be (or are) deposited in a named collection (see [Recommendation 16C](#)). The statement of intent, therefore, is to ultimately transfer and to deposit all specimens in the inappropriately labeled “*Other Marine Invertebrates*” collection ([Ref.](#) Dec., 2010) of Te Papa Tongarewa Museum, Wellington, NZ. A precedent is several specimens listed by Lee (1959) held in Canterbury Museum, Christchurch being later transferred to Te Papa (see Appendix 2).

Specimens are given a provisional code beginning with the hash symbol #. Specimens #1-7 were collected by S. Boyer around August, 2010 and sent to the author in Tokyo for identification from whence tissue samples were taken and sent for DNA analysis before they were personally returned to Lincoln. Those numbered #8 onwards were collected by R. Blakemore, S. Boyer & Steve Woods on 11<sup>th</sup> November, 2010. “W.000000” refers to impending Te Papa registration. Other materials are as individually noted.

Most specimens (#1-20) were from the same location: part of the Cypress Mine informally known by early miners as “*Happy Valley*” in a proposed extension of the Stockton mine operated by state-owned Solid Energy New Zealand Ltd (“SENZ”) in the Upper Eastern Waimangaroa Valley (NZMS 260 L29 150450 ca. 700 m altitude) of the Buller Region near Westport (ca. 171° 36’ 08’ E 41° 45’ 29’ S) on the West Coast of New Zealand’s South Island. A part of Ngakawau Ecological district, geological, climatic and ecological information is found in Bruce ([2006](#)) who says: “*Significantly, unlike many remnant native areas, no sign was found of introduced flora in the valley*”. This is pertinent as neither were exotic earthworms found on site (pers. obs.) which in terms of Oligochaeta is highly diverse, possibly the most biodiverse in NZ. Other specimen localities and collectors are listed with the species as described in the Results.

## Results

### Ecology

It is unnecessary to repeat the ecological characteristics at the Happy Valley location where the earthworms are subject to predation by birds, specifically including *Apteryx haastii* Potts, 1872 the Great Spotted Kiwi or Roroa (S. Woods pers. comm. and many beak probe holes visible on site – pers. obs.) that is listed as “*Vulnerable*” by IUCN, and the rare snail *Powelliphanta aff. rossiana patrickensis* (Powell, 1949) that is classified by the NZ Department of Conservation (DOC) as being “*Endangered*” ([Ref.](#)). Particular habitat, gut contents or parasite burden are included with the following species’ taxonomic descriptions.

### Taxonomy

Acanthodrilidae Claus, 1880

#### *Decachaetus erici* sp. nov.

[Fig. 1.](#) *Decachaetus erici* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #17 from Manuka (*Leptospermum scoparium*) scrub/tussockland at Happy Valley. Collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, posterior amputee missing tip of ‘tail’, anaesthetized then fixed in ethanol 98% and stored in 80% EtOH.

**Etymology:** Based on Latin word for ‘studded’ or with studs/spikes – for its appearance.

**External characters:** Distinct spotted appearance with brown pigment separated by pale setal auriolae with darker pigment intersetally and as mid-dorsal stripe; male field pale. Body circular in anterior. Length 25+ mm. Prostomium tanylobous. Setae perichaetine, twelve per segment in anterior, appearing to increase further posteriorly. Clitellum buff, 14-16. Dorsal pores from 11/12. Nephropores lateral near anterior of segments in d lines. Spermathecal pores raised and pale in 7/8/9 just median to c lines. Female pores anterior to setae a on 14. Prostatic pores raised approximately in b lines on 17 and 19; penial setae not found in position of (occluded) b setae. Male pores within seminal

grooves approximately in b lines. Genital markings noted only as small pale discs paired below b setae on 8.

**Internal morphology:** Septa mostly thin and translucent. Proventriculus wide and S-shaped in 5. Gizzard weakly marked in 6. Dorsal blood vessel doubled, at least after clitellum. Last hearts in 12. Nephridia avesiculate holoic. Spermathecae in 8 and 9 each with a pair of opposed diverticula. Testes free, postero-ventrally in 10 and 11. Seminal vesicles saccular, in 9, 10, 11 and 12. Ovaries in 13. Prostates tubular in 17 and 19 exiting through flacid ducts; penial setae not found. Oesophagus dilated in 14-15 but not lamellar and not construed as calciferous glands. Intestinal origin around 19 and typhlosole not found (intestine damaged). Gut contains brown organic matter.

**Ecology:** Unidentified nematodes noted in coelom (parasitic cf. Yeates *et al.*, 1985) and opened intestine (incidental?). Dark pigmentation and gut contents suggest habitat in the organic layer of soil, perhaps in litter or peat.

**Remarks:** Superficially the colouration is reminiscent of megascolecine *Diporochaeta punctata* Lee, 1959 and acanthodriline *Plagiochaeta sylvestris* (Hutton, 1877) with its junior synonym *P. punctata* Benham, 1891. It differs from the latter taxon by having fewer than 30-50 setae per segment, non alternating nephropores and in other respects. By virtue of its holoic nephridia in series, non-lumbricine setae and an acantodriline male field it complies with genus *Eudinodriloides* Lee, 1959: 72, that was previously monotypic for *E. forsteri* Lee, 1959: 73. The current species differs from the *E. forsteri* type, not least, in its distinctive colouration; gizzard in 6 rather than 5; avesiculate nephridia; and its genital markings in 8. However, this genus appears to be encompassed by page prior *Decachaetus* Lee, 1959: 38 and, from its decasetal type-species: *D. violaceus* Lee, 1959, the current species' setal arrangement differs although, as just noted, beyond lumbricine (8 setae) vs. non-lumbricine (>8) this character is not usually accorded significance above the specific level. The two genera are henceforth amalgamated under the name *Decachaetus* Lee, 1959 (syn. *Eudinodriloides* Lee, 1959) with the new addition amending the combined generic definition to accept last hearts in 12 and nephridia either avesiculate or with small (terminal) bladders.

*Diplotrema bilboi* sp. nov.

[Fig. 2.](#) *Diplootrema bilboi* Blakemore, 2010. Holotype – dorsal view of prostomium, ventral view of body with spermathecae and prostates *in situ*. Boxed sketch is of a spermatheca from Paratype.

**Material Examined:** Holotype (H) W.000000. Specimen #4 from tussock grassland; collected by S. Boyer, ca. August 2010. Mature, posterior amputee with tip of ‘tail’ missing, in propylene glycol. Specimen #5 with same collection data but poorly preserved – W000000 (Paratype P1). Specimen #11 from same location but collected by S. Boyer, R.J.B. and S. Woods on 11<sup>th</sup> November, 2010 is superficially similar (and this supported by preliminary COI barcoding data) – W.000000 (Paratype P2).

**Etymology:** After Bilbo Baggins, the eponymous subject from J.R.R. Tolkien’s *The Hobbit* that opens: “*In a hole in the ground there lived a hobbit*”; also obliquely referencing via *Lord of the Rings* to Lamarck’s 1802 *Les Annélides* – “*The Ringed Ones*”.

**External characters:** Body circular in anterior. Yellowish tinge to a milky coloured body; clitellum pale buff. Length 75+ mm (H), 75 mm (P). Segments 125 (H), 130 (P). Prostomium prolobous or weakly epi-tanylobous. Setae lumbricine. Clitellum ½13-½18,18. Dorsal pores apparently commencing around 12/13 (P) but not obvious until clitellum ends in 17/18 or 18/19 (P and H). Nephropores lateral in c lines. Spermathecal pores in 7/8/9 near b lines. Female pores antero-median to setae a on 14. Prostatic pores raised approximately in b lines on 17 and 19; penial setae not found in position of (occluded) b setae, setae a appear normally. Male pores within seminal grooves approximately in b lines. Genital markings as small paler discs paired anteriorly in 8 and 9 and posteriorly in 9, 10 and 11 (H), or anteriorly in 8 and posteriorly in 8, 9, 10 and 11rhs (P); faint markings intersegmentally in 8/9/10 in a lines in H.

**Internal morphology:** Septa 8/9-10/11 with some thickening. Pharyngeal mass to 4/5. Muscular gizzard in 6. Dorsal blood vessel doubled where observed. Commissural vessels in 7-9 and hearts in 10-12. Nephridia classed as avesiculate holoic but in some segments (e.g. 13 in H) seem to be almost separate near the base, i.e., possibly incipiently transitional to meroic. Spermathecae paired in 8 and 9 each with a small pair of opposed diverticula. Testes and funnels free ventrally in 10 and 11. Seminal vesicles racemose, in posteriorly in 9, anteriorly in 11 and 12. Ovaries small fan-shaped in 13. Prostates tubular in 17 and 19 exiting through flaccid ducts; penial setae not found; copulatory

muscles not identified although there are some tendons laterally in 18. Oesophagus dilated and internally lamellar in 16 as an annular calciferous gland. Intestinal origin in 19 with large lamellar typhlosome developing from around 22. Gut contains colloidal soil with some quartz grits and organic matter. No glands were found internally in position of external genital markings.

**Ecology:** Its habits, symbionts, and predators are unknown, neither were parasites found. However, pale body suggests either deep burrowing (partially supported by soil in gut - indicative of geophagy) with possibly nocturnal/crepuscular surface activity.

**Remarks:** In Lee (1959) this species keys out to *Eodrilus* Michaelsen, 1907, a genus long in synonymy of *Diplotrema* Spencer, 1900 (see Blakemore, 1997; 2005; 2008) that occurs primarily in northern Australia with unverified Central American reports. Possibly the closest New Zealand species are *Diplotrema paludosus* (Beddard, 1892) and *D. annectens* (Beddard, 1889) that mutually differ, respectively, in sizes of ca. 25 mm or 70-110 mm; gizzard in 6 or in 5; either two or four spermathecal diverticula; and genital papillae in 11, 12 and 18 or papillae in 15, 16 and some of 18-20 [although markings were not mentioned by Lee (1959), these accord with Beddard's (1895: 544) descriptions]. Neither species has calciferous glands in 16 and, moreover, in regards to the distribution of its genital markings and its last hearts in 12, the current species appears unique to the genus as currently known from New Zealand.

*Maoridrilus felix* sub-spp. novae

[Fig. 3](#). *Maoridrilus felix felix* Blakemore, 2010. Holotype showing dorsal view of prostomium and pygidium, and ventral view of body with spermathecae and prostates *in situ*; nephridium of 6lhs is as seen from dorsal dissection.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype of *M. felix felix* sub-sp. nov.). Specimen #1 from tussockland at Happy Valley. Collected by S. Boyer, August, 2010. Mature, complete, fixed in ethanol and placed in propylene glycol. W.000000 (Holotype of *M. felix vallis* sub-sp. nov.), specimen #15 from Happy Valley that has superficial genital markings on 10, and its segment 12 is tumid otherwise is superficially similar to *M. felix* but according to preliminary DNA sequencing (of COI barcode

markers) it differs slightly from *M. felix felix*. Further analysis of this latter specimen is required and both require comparison with *M. transalpinus* Lee, 1959 redescribed below.

**Etymology:** *Felix* is adjectival Latin for “Happy”, and *vallis* means “from the valley”, both after the colloquial location name.

**External characters:** Body circular in anterior, squaring off in mid-body and dorsally canaliculate in the posterior 50 or so segments. Pigment dark, especially dorsum chocolate brown with darker mid-dorsal stripe. Length 170 mm with 199 segments (#1). Prostomium tanylobous. Setae lumbricine. Clitellum faintly marked 15-19, ½20. Dorsal pores wanting. Nephropores, after the first few segments, alternate regularly between c and b lines with anterior segmental distributions: 3-7c, 8 c or b, 9-10c, 11b, 12c, 13b, etc. Spermathecal pores in mid-ab lines in 7/8 and 8/9. Female pores faint, just anterior to b setae on 14. Prostatic pores approximately in a lines on 17 and 19 with protuberant penial setae. Male pores not located within concave seminal grooves, although likely central between retained ab setae. Genital markings absent, but setae ab on 16 with slight pale tumescence as on 20lhs (H *M. felix felix*); or present on 10 (H *M. felix vallis*). Genital setae absent; penial setae longish, curving with spoon-shaped tips. [Note: one function of penial setae, if not primary function, is to scrape out or disrupt any prior semen from spermathecal diverticula that, at least when clavate, often correspond in depth to the setal length (see Blakemore 2000)].

**Internal morphology:** Pharyngeal mass anterior to 4/5. Septa mostly thin and translucent. Proventriculus wide and S-shaped in 5. Gizzard muscular in 6. Dorsal blood vessel single throughout. Heart paired in 10-13. Nephridia holoic with long, sausage-shaped vesicles. Spermathecae in 8 and 9 each with a multiloculate diverticulum (inseminated) transcending anterior septum. Testes free, postero-ventrally in 10 and 11. Seminal vesicles saccular, antero-dorsally in 11 and 12. Ovaries compact sheets in 13 with large oviducts; ovisacs not found. Prostates tubular in 17 and 19 exiting through muscular ducts with ectal penial setal sheathes and tendons. Vasa deferentia seen to 18. Oesophagus dilated in 11-15 with blood vessels attaching dorsally but not saccular and not construed as calciferous glands. Intestinal origin in 18. Typhlosole not detected to about 26. Gut contains colloidal organic matter.

**Ecology:** Lack of dorsal pores is more usually associated with a semi-aquatic habitat. Unidentified nematodes (cf. Yeates *et al.*, 1985) were found near prostates in *M. f. felix*.

**Remarks:** Quintessentially *Maoridrilus* due to alternating nephridiopores, this species is distinct in its lack of dorsal pores (as with *M. transalpinus* Lee, 1959, at least, although more information is needed on several other congeners), gizzard in 6, lack of oesophageal glands, and genital marking absence (*M. f. felix*). Multiloculate spermathecae appear characteristic of the genus and in the current species their form is almost identical to *Maoridrilus thomsoni* Benham, 1919: fig. 4 from D'Urville Island in Cook Strait. Lee (1959) held this species, along with similar *M. intermedius* Michaelsen, 1923 and *M. mauiensis* Benham, 1904, as *incertae sedis* because original descriptions were inadequate. Permanence of the name *M. felix* depends on redescription of *M. thomsoni*, however, the manifestly larger penial setae and lack of oesophageal glands in 14-16 seem to separate the current species. *Maoridrilus nelsoni* Lee, 1959 differs in its prostatic pores in b lines, and its prominent tuberculae pubertatis ventrally on segments 10 and 16. *Maoridrilus uliginosus* (Hutton, 1877) differs, perhaps not least, in its paired dorsal blood vessel. Avesiculate *M. transalpinus* Lee, 1959 is redescribed and compared below, especially to the sub-species *M. f. vallis*.

***Maoridrilus suteri ama* sub-sp. nov.**

[Fig. 4.](#) *Maoridrilus suteri ama* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*, plus lateral view of markings on 8 and 9.

**Material Examined:** Holotype (H) Te Papa Tongarewa W.000000. From Ahuriri Bush, Banks' Peninsula, near Christchurch. Collected by Mike Bowie, 15<sup>th</sup> November, 2010. Mature, complete, anaesthetized in dilute alcohol and fixed in 85% EtOH. W.000000-0 (Paratypes 1-2). From Kennedy's Bush, near Christchurch. Collected by Mike, Bowie, 15<sup>th</sup> November, 2010 – a damaged posterior amputee (P1) and a complete mature (P2). Specimen: Lincoln University collection: from Orton Bradley Bush No. 2, Mike Bowie, pitfall 8.XII.1999, a damaged mature. Other specimens, their characteristic markings visible to the naked eye, were collected from Banks' Peninsula, 18<sup>th</sup> November, 2010 by

Mike Bowie collection team, including the current author, especially under logs beside woodland tracks.

**Etymology:** From Maori word *ama* for “outrigger” – as in *ama waka* for outrigger canoe – referring to the distinctive lateral markings that are reminiscent of such structures.

**External characters:** Body circular in section in the anterior with distinctly squared tail in posterior. Pigment greeny-brown in life, duller in alcohol with khaki clitellum. Length 195 mm with 210 segments (H); 160 mm (P2). Prostomium tanylobous. Setae lumbricine. Clitellum faintly marked  $\frac{1}{2}13$ -  $\frac{1}{2}19$ . Dorsal pores wanting but appear weakly on terminal segments. Nephropores, after the first few segments, alternate between ab and cd lines. Spermathecal pores in a lines in 7/8 and 8/9. Female pores just anterior to b setae on 14. Prostatic pores approximately in setal a lines on 17 and 19 absorbing ventral setal couples. Male pores not located within straight seminal grooves between retained ab setae. Genital markings as noticeable pads lateral from setae b in some or all of segments 8-11 (i.e. two to four per side) acting as unspecified “outrigger markings”; plus erstwhile tumidity around ventral setae of 15,16 and 20,21. Genital setae absent; penial setae present.

**Internal morphology:** Pharyngeal mass to 4/5. Septa 10/11-13/14 slightly thickened. Gizzard large and muscular in 6. Dorsal blood vessel double in 14-16 (at least) recombining at intersegments. Last hearts paired in 13. Nephridia vesiculate holoic with small, spherical terminal bladders. Spermathecae in 8 and 9 each with compact (‘cauliform’) diverticulum. Testes free, in 10 and 11. Seminal vesicles saccular, large paried anteriorly in 11 and 12. Ovaries as sheets of egg-strings in 13; ovisacs not found. Prostates tubular in 17 and 19 exiting through muscular ducts with long, curving penial setae ectally [one rôle, if not their primary function, is to scrape out or disrupt prior semen from spermathecal diverticula that often correspond in depth to the setal length (see Blakemore 2000)]. Only a few fibrous tendrils seen in 18 around male pores. Oesophagus dilated and pale in 14 and, more pinkish, in 15 as weak ‘calciferous glands’. Intestinal origin in 19. Typhlosole not detected. Gut contains soil and organic matter.

**Ecology:** Collected under logs and rocks on Banks’ Peninsula also from pitfall trap with other Orton Bradley pitfall specimens (batch No. 4 collected 11.I.2000 by Mike Bowie) being identified by RJB as lumbricids *Octolasion cyaneum* (Savigny, 1826),

*Apporectodea caliginosa* (Savigny, 1826), several immature worms and various orange with black striped predatory planaria; plus numerous spiders, slaters/woodlice, ants, etc.

**Remarks:** This species is similar to both *Maoridrilus parvus* Ude, 1905 and *M. suteri* Michaelsen, 1922 that are co-incident around Christchurch although the former is additionally reported from Port Hills, Lyttleton. Lee (1959: 216) did not locate the types of *M. parvus* but a catalogue later published by Hartwich & Kilius (1989) lists them (it?) as “*Berlin 7321*” while giving authorship as “*Ude, 1905: 410-413, Tab. 17, figs. 2a-b*”. For *M. suteri* the types are in Leiden. These two species are rather poorly known and are similar enough in most characters to perhaps merit merger. The current species, which is only given provisional sub-species ranking because of this ambiguity of both prior taxa, comes closer to definitions in Lee (1959) of *M. suteri*, differing specifically in it having spermathecal pores slightly closer to setal a lines, rather than in ab; and dorsal blood vessel doubled in 14-16 rather than in 10-14 as in *M. suteri*; additionally, the genital markings found in *M. suteri ama* are mentioned neither for *M. sueteri suteri* nor for *M. parvus*. The permanence of all these names depends on morphological inspection and genetic analysis of the types, progressively under ICZN (1999) Principal of Priority, on materials held in these European institutions. Demonstration of their mutual lack of characteristic ‘outrigger’ markings, hitherto unmentioned, would also determine the validity of the taxon newly proposed herein.

***Maoridrilus transalpinus* Lee, 1959.**

Synonymy: *Maoridrilus transalpinus* Lee, 1959: 233; Blakemore, [2004](#), 2005, 2007, [2007](#); Marshall, 2005: 48. [Type [W.000523](#) from Lake Mahinapua Forest Reserve, Westland under leaf mould in podocarp-broadleaved forest].

[Fig. 5](#). *Maoridrilus transalpinus* Lee, 1959. Specimen showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Specimen). From alpine herbfield at Arthur’s Pass (ca. 42°56’S 171°34’E, ~700m). Collected by R.J. Blakemore, 12<sup>th</sup> November, 2010 under rocks near heath and cushion moss. Mature, posterior amputee, anaesthetized then fixed and stored in 80% ethanol in labeled jar.

**External characters:** Body circular in section. Pigment brown, clitellum slightly darker. Length 163 mm with 231 segments. Prostomium tanylobous. Setae lumbricine. Clitellum faintly marked 14-19. Dorsal pores wanting. Nephropores, after the first few segments, alternate between c and b lines, irregularly in places, most noticeable on and after clitellum. Spermathecal pores in mid-ab lines in 7/8 and 8/9. Female pores just anterior to b setae on 14. Prostatic pores approximately in a lines on 17 and 19 with protuberant penial setae. Male pores not located within concave seminal grooves, although likely central between retained ab setae. Genital markings absent, but setae ab on 10 within elongate dumbbell-shaped pale tumescence. Genital setae absent; penial setae longish.

**Internal morphology:** Septa 9/10-12/13 slightly thickened. Proventriculus wide in 5. Gizzard muscular in 6. Dorsal blood vessel single. Last hearts paired in 13. Nephridia avesiculate holoic. Spermathecae in 8 and 9 each with compact (multiloculate or ‘star-shaped’) diverticulum transcending anterior septum. Testes free, in 10 and 11. Seminal vesicles saccular, small pair in 10 and larger in 11 and 12. Ovaries in 13; ovisacs not found. Prostates tubular in 17 and 19 exiting through muscular ducts with ectal penial setae. Oesophagus increasingly dilated with internal lamellae internally in 13,14-16 as calciferous glands; darker and contracted in 17-½18. Intestinal origin in ½18. Typhlosole not detected. Gut contains only colloidal organic matter.

**Ecology:** Heavily infested with gregarine (*Monocystis*) sporozoan parasites, especially around prostate region.

**Remarks:** Belonging in *Maoridrilus* as defined by its alternating nephridiopores, this specimen complies with Lee’s species in most points. Slight differences are that there are weak genital markings in 10 (that may be an aberration or easily overlooked), the oesophageal glands are annular rather than “paired” as shown in Lee’s figures, and the spermathecal diverticula are more clavate which may, however, be due to stage of maturity. This species is similar to *Maoridrilus felix* as described herein that typically differs from *M. transalpinus* by lacking genital markings in 10 although these are present in the *M. felix vallis* sub-species, further on manifest nephridial vesicles, a lack of seminal vesicles in 10 and absence of marked oesophageal glands as occur in *M. transalpinus*.

Octochaetidae Michaelsen, 1900 *sensu* Blakemore, 2000

***Deinodrillus gorgon* sp. nov.**

[Fig. 6.](#) *Deinodrillus gorgon* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*; gizzard is in 6.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype, H). Specimen #3 from tussockland at Happy Valley. Collected by S. Boyer, 2010. Mature, posterior amputee, fixed in ethanol 98% and placed in propylene glycol. Specimen #14 from Happy Valley. Collected by S. Boyer, R.J.B, S. Woods - W.000000 (Paratype, P)

**Etymology:** Noun alluding to Greek mythical chthonic (i.e., “*in, under, or beneath the earth*”) monsters with sharp fangs, staring eyes and, similar perhaps to the ring of diverticula on each spermatheca, a belt of serpents.

**External characters:** Body circular in anterior. Pigment dark, especially dorsum with paler setal auriolae; clitellum and male field white. Length 55+ mm with 73+ segments (amputee). Prostomium tanylobous. Setae perichaetine, 12 per segment, evenly spaced. Clitellum pale, tumid  $\frac{2}{3}$ 13-16. Dorsal pores from 10/11. Nephropores not found. Spermathecal pores in b lines in 7/8 and 8/9, small but gaping. Female pores antero-ventral to setae a on 14 in common field. Prostatic pores at b on 17 and 19. Male pores within concave seminal grooves lateral to b on 18. Genital markings as large eye-shaped papillae paired on 10; with smaller markings on 13rhs, 16 rhs and two additional pairs on 18 as figured. Genital and penial setae not found. Paratype (#14) is superficially similar and preliminary DNA analysis of COI barcode marker supports this conclusion.

**Internal morphology:** Pharyngeal mass anterior to 4/5. Septa 8/9-10/11 with some thickening. Gizzard muscular in 6 (weak septum 6/7 can be carefully teased off to base). Dorsal blood vessel doubled. Heart paired in 10-13. Nephridia meroic; equatorial forests especially obvious around clitellar segments. Spermathecae in 8 and 9 each with a thin duct to multiple, finger-like diverticula, five per spermatheca (inseminated) surrounding duct from where it thickens before reaching yellowish, knob-like ampulla. Testes free, postero-ventrally in 10 and 11. Seminal vesicles small saccular in 9 (vestigial?) and

larger racemose anterio-dorsally in 11 and 12. Ovaries fan-shaped in 13 with several strings of largish eggs; ovisacs vestigial in 14. Prostates compacted tubular in 17 and 19 exiting through muscular ducts. Vasa deferentia seen to exit unceremoniously in 18. Oesophagus dilated in 15-17 but lacking internal lamellae and thus not construed as calciferous glands. Intestinal origin in 18. Typhlosole thin, lamellar becoming deeper from 19. Gut contains colloidal soil and organic matter.

**Ecology:** Dark colouration suggests at least intermittent surface exposure on topsoil.

**Remarks:** Of the eight currently known *Deinodrillus* species, only two have tanylobous prostomia: *D. gracilis* Ude, 1905 from Stephen Island and *D. parvus* Lee, 1959 from Mangamuku Range. Both also have 5 or 6 spermathecal diverticula however, *D. gracilis* has copulatory setae, oesophageal glands and intestine from 19; while *D. parvus* has a saddle-shaped clitellum in 12-16, and all its reproductive pores are all in a or ab. Further, their gizzards are in 6-7 (unless this is a miscount by Ude?) and 5, respectively, rather than single in 6 as in the current species. *D. montanus* Lee, 1959 from Rimutaka Range is similar to *D. parvus* and differs for similar reasons. The current species appears unique in the distribution of its eye-like genital markings that are especially noticeable on segment 10.

***Deinodrillus medusa* sp. nov.**

[Fig. 7.](#) *Deinodrillus medusa* Blakemore, 2010. Holotype (H) showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

Sketch box is of prostomium, spermathecae and intestinal origin of Paratype (P).

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #6 from tussockland at Happy Valley. Collected by S. Boyer, 2010. Mature, complete, fixed in EtOH 96% and placed in propylene glycol. Specimen #12 from same location, collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, missing tip of tail, anaesthetized before being fixed and preserved in 80% EtOH - W.000000 (Paratype).

**Etymology:** In ancient Greek mythology, one of the three gorgon sisters, Medusa (Μέδουσα = “guardian, protectress” – a singular feminine noun) was a chthonic but mortal monster here named for reasons similar to *D. gorgon*, also alluding to their mutual affinity.

**External characters:** Body circular in anterior and pale or unpigmented, clitellum buff. Length 44+ mm with 70+ segments (H, amputee); 80+ mm (P, amputee). Prostomium closed epilobous (H) or almost epi-tanylobous (P). Setae perichaetine, 12 per segment, evenly spaced. Clitellum mostly annular,  $\frac{2}{3}$ 13-16. Dorsal pores vestigial from 11/12, most obvious after clitellum. Nephropores not found. Spermathecal pores in b lines in 7/8 and 8/9. Female pores antero-ventral to a setae on 14 almost mid-ventral. Prostatic pores near setae b on 17 and 19 at termini of grooves. Male pores within concave seminal grooves just lateral to setal b lines. Genital markings as eye-shaped papillae paired in Holotype on 8 in mid bc, on 10 in mid ab, and midventral in 11-13 then paired or single in 16-20 as figured; in the Paratype they are in 10 (widely paired), in 11-13 and 18 mid-ventrally either as an opposed pair or single, and widely paired again in 20. Genital and penial setae not found.

**Internal morphology:** Septa, none especially thick. Gizzard appears to be in 6-7, most likely due to flimsy septum 6/7 meeting it half-way to its base, but more likely wholly in 6. Dorsal blood vessel doubled. Last hearts paired in 13. Nephridia avesiculate meroic. Spermathecae in 8 and 9 each with a thin duct to multiple, finger-like diverticula, three or four per spermatheca (inseminated) surrounding duct from where it thickens before reaching yellowish, saccular ampulla. Testes free, ventrally in 10 and 11. Seminal vesicles in 9, 10, 11 and 12. Ovaries as several thin and long egg-strings in 13. Prostates convoluted tubular in 17 and 19 exiting through moderately muscular ducts. Oesophagus dilated in 14-15 but lacking internal lamellae and not calciferous glands; 16-17 valvular. Intestinal origin from 17 with thin lamellar typhlosole developing soon after in 20. Gut contains many quartz grits and some woody organic matter. Paratype complies internally.

**Ecology:** Pale colouration and soil digestion suggests a subsoil habitat.

**Remarks:** The type-species of the genus is *Deinodrilus benhami* Beddard, 1889 and synonyms include *Dinodrilus* (laps.) Michaelsen (1900) and *Conicodrilus* Benham, 1945 according to Lee (1959: 43). Of the eight *Deinodrilus* species described by Lee (1959), the current taxon keys out to *Deinodrilus agilis* Lee, 1952. It differs from this taxon by virtue of its female pores not being near b lines; oesophageal glands rather than being present in 9-13 occurring in 14-15; seminal vesicles in more than just 11 and 12; and,

moreover, *D. agilis* is from the North Island. The current specimen is especially similar to *D. gorgon* that appears unique within the genus due to the distribution of its eye-like genital markings that are especially noticeable on segment 10. The current taxon and *D. gorgon* appears to differ on specific details of their genital markings; their prostomia; spermathecal form – in particular the numbers of diverticula and ampullae proportions; and on their arrangement of oesophageal glands and intestinal origins. Further analysis (preferably molecular) is required to test the possibility that this is a species complex with members meriting only sub-specific status; conversely it could be a manifestation of some putative ‘cryptic species’.

***Octochaetus diememoratio* sp. nov.**

[Fig. 8.](#) *Octochaetus diememoratio* Blakemore, 2010. Holotype (bisected at clitellum) showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #9 from Manuka scrub/tussockland at Happy Valley of Stockton minesite near Westport, NZ. Collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, damaged unintentionally amputated and bisected, anaesthetized then fixed in 80% EtOH.

**Etymology:** From Latin for the “Remembrance Day” (11<sup>th</sup> November) collection date.

**External characters:** Body circular in anterior. Pigment pale unpigmented, clitellum pinky white. Length 100+ mm (amputee). Prostomium prolobous, peristomium highly wrinkled/furrowed. Setae lumbricine, 8 per segment. Clitellum tumid (annular) in 13,14-19. Dorsal pores openly visible after clitellum. Nephropores not found. Spermathecal pores centred in b lines in 7/8 and 8/9. Female pores not found (damaged). Prostatic pores in near b lines on 17 and 19. Male pores within concave seminal grooves appearing just lateral to setal b lines. Genital markings as lenticular patches around spermathecal pores and in the same line in 9/10 and 10/11; two additional pairs ill-defined either side of male field on and after the clitellum, the last pair seemingly in 21/22. Genital and penial setae not found.

**Internal morphology:** Septa, 5/6-12/13 thickened. Gizzard in 5 preceded by large crop. Dorsal blood vessel doubled. Last hearts paired in 13. Nephridia avesiculate meroic

comprised of numerous small ‘tufts’. Spermathecae in 8 and 9 each with multiloculate diverticulum on short duct below bulbous ampula. Testes free, in 10 (non iridescent) and in 11. Seminal vesicles in 9 (small), 11 and 12 (large). Ovaries not clearly found in 13 (damage). Prostates highly convoluted tubular in 17 and 19 exiting through much coiled ducts. Male field not particularly muscular. Oesophageal glands lacking. Intestinal origin from ca. 20; typhlosole after 20 not noted. Gut contains soil with grits.

**Ecology:** Large size, pale colouration and soil digestion suggests a subsoil habitat (Lee’s “*sub-soil dwelling*” ecological category).

**Remarks:** In Lee (1959) the current taxon keys out to *Octochaetus huttoni* Beddard, 1892 that is described as similar size and shares some attributes. The current taxon differs by virtue of its spermathecal pores in b lines rather than “*anterior to chaetal interval ab*” and its diverticula, although similarly composite, are larger than “*the size of a pin’s head*”. Further differences are a lack of oesophageal glands, rather than having them in 15-16, and its last hearts in 13 rather than in 12. Moreover, the distinctive genital markings not noted by Beddard (1895) nor Lee (1959) appear unique to this new taxon.

***Octochaetus kenleei* sp. nov.**

[Fig. 9.](#) *Octochaetus kenleei* Blakemore, 2010. Holotype showing dorsal view of prostomium and pygidium, and ventral view of body with spermathecae and prostates *in situ*; gizzards are in 5 and 6 and calciferous gland is in 17; enlarged 9rhs spermatheca shows nephridia on either side.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #2 from tussockland at Happy Valley. Collected by S. Boyer, 2010. Mature, complete, fixed in ethanol 98% and placed in propylene glycol.

**Etymology:** In patronymic tribute to the foremost earthworm eco-taxonomist of New Zealand and beyond, Dr Kenneth Earnest Lee (1927-2007). With this I discharge my promised obligation at ISEE9 in Mexico to name the next NZ species in honour of Ken – my mentor, PhD assessor and inspiration to continue earthworm studies despite all odds.

**External characters:** Body circular but posterior slightly square. Pigment lacking and generally fair. Length 220 mm with 270 segments. Prostomium prolobous. Setae lumbricine, 8 per segment, evenly spaced. Clitellum not well marked, perhaps in some or

all of 14-20. Dorsal pores from 14/15, small. Nephropores not clear, some possibly in c and d lines or rather irregular. Spermathecal pores segmental, lateral to b lines on 8 and 9 on small mounds. Female pores just anterior to setae a on 14. Prostatic pores at b on 17 and 19. Male pores within concave seminal grooves lateral to b. Genital markings as small lens-shaped hollows paired in 8/9 and 9/10 near b lines and in 15/16 in a lines with a unilateral marking in 18/19lhs; area bb in 19/20-22/23 tumid. Genital and penial setae not found.

**Internal morphology:** Pharyngeal mass anterior to 4/5. Septa 8/9-10/11 with some thickening. Gizzards muscular in 5 and 6. Dorsal blood vessel appears single on gizzards but is doubled from 7 posteriorly. Heart paired in 10-13. Nephridia merioic as a few (ca. 4 per side) small tufted clusters in each segment. Spermathecae in 8 and 9 saccular each with small discrete and interocular diverticula (inseminated) ringing exit. Testes free, postero-ventrally in 10 and 11. Seminal vesicles large finely racemose antero-dorsally in 11 and 12. Ovaries composed of several strings of largish eggs in 13; ovisacs absent. Prostates tubular in 17 and 19 exiting through narrow ducts. Vasa deferentia exits in 18. Oesophagus dilated as annular calciferous gland in 17 with several internal lamellae but not especially vascularized. Intestinal origin in 20 (valvular in 19). Typhlosole large inverted T-shape developing from 21. Gut contains colloidal soil with a few quartz grits and woody fragments.

**Ecology:** Large size, pale colouration and gut contents suggest subsoil geophagy.

**Remarks:** The current species is compared to *Octochaetus thomasi* Beddard, 1892, widespread in the Canterbury Plains, that is the only other congener known to have gizzards in 5-6 that also has, as with all other known congeners, spermathecal pores in 7/8/9 and alone in its character of segmental pores in 8 and 9 the current species is differentiated. *Neodrilus campestris* (Hutton, 1877) from Dunedin reportedly has segmental spermathecal pores (on 8) but differs, not least, by qualifying for inclusion in Acanthodrilidae due to its holoic nephridia.

Megascolecidae Rosa, 1891 *sensu* Blakemore, 2000

*Diporochaeta pounamu* sp. nov.

[Fig. 10.](#) *Diporochaeta pounamu* Blakemore, 2010. Holotype showing dorsal view of prostomium plus pygidium and ventral view of body with spermathecae and prostates *in situ*; calciferous glands in 10 and 11 are shown and there is a sketch of a commensurate and coincident cocoon.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #8 from Manuka scrub at Happy Valley. Collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, complete but damaged during collection poorly preserved after being anaesthetized in dilute alcohol then fixed in concentrated EtOH.

**Etymology:** For its deep green colouration that resembles Maori *pounamu* (greenstone).

**External characters:** Body circular in anterior but becoming flattened and with the posterior distinctly flat and rounded, like a Maori *mere* (war club). Pigmentation deep green throughout but with the anterior slightly pinkish due to vascularization in life. Clitellum darker green in ca. 14-17. Length when relaxed (in life) 300 mm, when contracted and preserved ca. 180 mm. Segments 110. Prostomium closed tapering epilobous. Setae perichaetine, ca. 60-70 per segment, small and difficult to determine exactly, with negligible dorsal and ventral gaps. Dorsal pores not found (minute?). Nephropores not found. Spermathecal pores approximately in d lines in 5/6/7/8/9. Female pores just antero-median to setal a on 14. Male pores combined with prostatic pores opening approximately in position of occluded d setae. Genital markings as widely paired (or unilateral) disc-shaped papillae anteriorly in 11-13 and, with some duplication, in 17-22 (arranged as figured).

**Internal morphology:** Septa strong and muscular with 11/12-14/15 the thickest. Gizzard moderately weak in 5. Dorsal blood vessel single. Hearts paired in 9,10-12. Nephridia avesculate holoic. Spermathecae four pairs in 6-9 each with small clavate diverticulum 6lhs with smaller secondary growth (all diverticula inseminated and iridescent). Testes free in 10 and 11. Seminal vesicles in 9 and 12. Ovaries small in 13. Prostates tubular with moderately muscular duct in 18. Penial setae not found. Oesophagus white and dilated as calciferous glands in 10 and 11 with internal lamellae. Intestinal origin apparently in 15. Typhlosole and caeca not found. Gut contains largish plant remains, colloidal soil and a few grits.

**Ecology:** Found at about 20 cm depth in moist peaty-loam soils under native vegetation (sphagnum, podocarps, beech, yellow-silver pine and rata), this species is possibly deep-burrowing but may be conjectured to be subject to predation, for example by predatory invertebrates, such as the endemic snails, or by birds such as the resident kiwi, when near the surface. Some mounds of cushion moss or sphagnum were found to have within their matrices largish/commensurate (ca. 10 mm wide) lemon-shaped but darkly pigmented cocoon cases which may possibly be attributed to this species. One is sketched.

**Remarks:** New Zealand is the home of *Diporochaeta* Beddard, 1890 that is characterized by megascolepine male pores with tubular prostates, non-lumbricine setae, and holoic nephridia. Ten diporochaetids are listed in Lee (1959), others are known from Australia and [two questionable species – see Blakemore (2007)] from southern India. The current species keys out closest to the type – *D. intermedia* (Beddard, 1888) – that is also found on the West coast of the South Island. It shares the characters of four pairs of clavate spermathecae and calciferous glands in 10 and 11. However, the two taxa differ otherwise on almost each feature and the current specimen may thus be taken as representative of a taxon new to Science.

*Diporochaeta intermedia* was initially misdiagnosed with last hearts in 11, rather than 12 or 13 as would be expected, and this may be partly attributed to Romanization of segmental counts rather than more familiar Arabic numerals as used by Michaelsen (1900) and by Blakemore (2000) – both publications which completely reviewed and revised all such known Megascolecidae genera, including *Diporochaeta*.

***Diporochaeta radula* sp. nov.**

[Fig. 11.](#) *Diporochaeta radula* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen #10 from Manuka scrub/ tussockland at Happy Valley site. Collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, complete, anaesthetized in dilute alcohol then fixed in EtOH 85%.

**Etymology:** *Radula* - Latin for ‘scraper’ alluding to its rough multi-toothed ventrum.

**External characters:** Body circular with dark brown colour, a darker mid-dorsal line and

paler ventrum that has distinct copper-green tinge in anterior to 1/27 and with turquoise cuticular iridescence. Clitellum whitish ca. 1/213-16. Length 47 mm. Segments 87. Prostomium open epilobous with peristomium cleft ventrally. Setae perichaetine, ca. 40 per segment, but exceedingly small and difficult to determine exactly, with negligible dorsal and ventral gaps, and – intriguingly – apparent but indeterminate duplication ventrally on ca. 7-12. These segments are difficult to count because of these apparent extra setae, also to lateral lines of possible paler sensory papillae and their indistinct intersegmental furrows. Dorsal pores absent. Nephropores lateral from 2, as pale patches in the anterior actually giving better indication of intersegments than setae. Spermathecal pores latero-ventral in 7/8/9. Female pores indeterminate within grey patch midventrally on 14. Male pores combined with prostatic pores opening indistinctly on 18. Genital markings not pronounced - weak in 8 (or 9) and possibly around male pores in 17-19?

**Internal morphology:** Septa weak. Gizzard compact in 5. Vascularization not determinable (blood vessels indistinct and no trace of haemoglobin noted). Nephridia vesiculate holoic; bladders tubular tapering to exits. Spermathecae paired in 8 and 9 each with small clavate diverticulum (inseminated and iridescent). Testes free in 10 and 11. Seminal vesicles in 9 - 12. Ovaries with large eggs in 13. Prostates long and tubular on moderately muscular duct is 18. Penial setae not found. Oesophagus lacking glands. Intestinal origin apparently in 16. Typhlosole and caeca not found. Gut contains dark organic matter with large organic fibre fragments (peaty soil).

**Ecology:** Found in moist peaty-loam soil.

**Remarks:** New Zealand *Diporochaeta* with two pairs of spermathecae in 8 and 9 as described by Lee (1959) are *D. aquatica* Benham, 1903 and *D. brachysoma* Benham, 1909, neither of which has a gizzard; also *D. caswelli* Lee, 1959 that has mid-ventral spermathecal pores and fewer setae; and *D. heterochaeta* Benham, 1909 that, apart from eponymously enlarged ventral setae, has its gizzard in 6 rather than 5. On the many other unique characters, the current species appears distinct. Its setae are both intriguing and illusive requiring inspection of other specimens. Should they actually prove to be in duplicated rows in some anterior segments this would perhaps justify a new genus designation and the name *Radula* may be available for it.

*Perionychella ngakawau* sp. nov.

[Fig. 12.](#) *Perionychella ngakawau* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen # 7 from tussockland at Happy Valley. Collected by S. Boyer, 2010. Mature, missing tip of tail, fixed in EtOH 98% then placed in propylene glycol.

**Etymology:** Named after the local Ngakawau River and Ecological District.

**External characters:** Body circular, pale unpigmented, clitellum buff ½13-17. Length 50+ mm with 110+ segments. Prostomium appears prolobous. Setae perichaetine, ca. 26 per segment but uneven from segment to segment, with noticeable dorsal and ventral gaps. Dorsal pores not found (minute?). Nephropores seen in f or g lines on clitellum. Spermathecal pores in ab lines in 6/7/8/9 appearing to progressively widen slightly. Female pores approximately in setal a lines on 14 in common paler field. Male pores combined with prostatic pores opening in common on paired porophores that occlude adjacent setae but are approximately in position of setae b. Genital markings as a wide lens-shaped patch in 17/18, the mark in 6rhs may be aartifactual.

**Internal morphology:** Pharyngeal mass seen 4. Septa all flimsy. Gizzard moderately weak in 5. Dorsal blood vessel single. Hearts paired in 10-12. Nephridia holoic, avesciculate throughout. Spermathecae in 7, 8 and 9 each with small clavate diverticulum (inseminated and iridescent). Testes free in 10 and 11. Seminal vesicles small in 9, 10, 11 and 12. Ovaries in 13. Prostates tubuloracemose with moderately muscular duct in 18. Oesophagus white and contracted in 13 and 14 with a few internal lamellae. Intestinal origin apparently in 15 (or 16). Typhlosole and caeca not found. Gut contains much organic matter and plant debris.

**Ecology:** Nothing yet known.

**Remarks:** Only four perionxyes are provided in Lee (1959). The current species keys out closest to *Perionyx shoeanus* Cognetti, 1912 from Auckland Islands that differs, not least, in having paired diverticula to its three pairs of spermathecae. The genital marking in 17/18, although faint, is perhaps another distinguishing feature of the current species. All four of the previously known endemic *Perionyx* Perrier species were transferred to

*Perionychella* Michaelsen, as originally defined, for which *Terriswalkerius* Jamieson from Qld is a junior synonym (see Blakemore, 2000b; 2004; 2005; 2007).

***Zacharius obo* sp. nov.**

[Fig. 13](#). *Zacharius obo* Blakemore, 2010. Holotype showing dorsal view of prostomium and ventral view of body with spermathecae and prostates *in situ*.

**Material Examined:** Te Papa Tongarewa W.000000 (Holotype). Specimen # 16 from tussockland at Happy Valley. Collected by S. Boyer, R.J.B. and S. Woods, 11<sup>th</sup> November 2010. Mature, complete, anaesthetized and fixed in EtOH.

**Etymology:** The formation of the name of this small white species alludes to a visual onomatopoeia – OBO – for the symmetrical circular markings either side of male pores.

**External characters:** Body circular, pale unpigmented, clitellum white 14-17. Length 28 mm with 90 segments. Prostomium open pro-epilobous. Setae lumbricine, 8 per segment, evenly spaced. Dorsal pores not found (minute?). Nephropores not found. Spermathecal pores in a lines in 7/8 and 8/9. Female pores anterior to setae a on 14. Male pores combined with prostatic pores opening in common field approximately in position of setae a. Genital markings as large eye-shaped central papillae in 16/17 and mirrored in 19/20. Genital and penial setae not seen.

**Internal morphology:** Septa all flimsy. Gizzard small and compact in 6. Dorsal blood vessel single. Last hearts paired in 12. Nephridia holoic, avesiculate; only obvious after clitellum and ducting laterally; small and difficult to detect in anterior segments but noted in 9 at least. Spermathecae in 8 and 9 each with clavate diverticulum but each differing slightly. Testes free in 10 and 11. Seminal vesicles small in 9 and 12 (at least?). Ovaries with large eggs in 13. Prostates tubuloracemose with weak duct in 18. Oesophagus slightly dilated in 8 and 9 but lacking internal lamellae and thus not construed as calciferous glands. Intestinal origin in 19. Typhlosole not found. Gut contains colloidal soil and some organic matter.

**Ecology:** Pale colouration suggests sub-surface or nocturnal activity; lack of dorsal pores usually signifies a waterlogged habitat.

**Remarks:** With lumbricine setae, holoic nephridia and non-tubular prostates in 18, this taxon complies with the generic definition of *Zacharius* Blakemore, 1997 that is found in

Northern NSW, Victoria, and Tasmania (see Blakemore, 2007 website) and is related to the plutelloids, differing mainly on its non-tubular prostates. This is the first generic record for New Zealand and no similar species are yet recorded. Preliminary DNA (COI barcode markers) results suggest Specimen #16 is the same as #7, obviously a mistake.

#### Lumbricidae Rafinesque-Schmaltz, 1815

Far from being the only other and/or co-dominant family in New Zealand – as is claimed by some mainly novice workers – no European lumbricids were collected from the Happy Valley, Arthur's Pass nor Banks' Peninsular sites in four or five day's survey reported here. The only lumbricids were from the pitfall traps at one Orton Bradley site. However, a single mature specimen of *Octolasion tyrtaeum tyrtaeum* (Savigny, 1826), as fully described by Blakemore (2002, 2008), was collected by the current author (RJB) from soil on a cliff-face at Punaikaki Beach Rd. near Greymouth, on the West coast. This represents a new record for New Zealand as other claims have apparently referred to the species (or sub-species) *O. lacteum* (Örley, 1885) – see Martin (1977). Thus, combined with the current new natives, this new lumbricid record raises the national NZ earthworm species tally to approximately 212 species from five families.

#### Microdriles including Enchytraeidae

In addition to the megadrile species described above, several aquatic or semi-aquatic microdriles and enchytraeids were collected from the Happy Valley site. Three clearly different species were observed plus unidentified enchytraeid species. Specimen #13 from Happy Valley, collected by S.B., R.J.B. and S.W. on 11<sup>th</sup> November, 2010 that was about 100 mm long is figured here ([Fig. 14](#) with a section of its internal organization in 6-10) for comparison, but no attempt is made at correct identification.

Including these minimum of four megadriles, the total Oligochaeta from the Happy Valley site to date to at least 16 species making it probably the most biodiverse habitat for earthworms in New Zealand (cf. 24 from Samford in Qld, Australia, and 23 from both Lake Pedder in Tasmania and Lake Biwa in Shiga-ken, Japan – see Blakemore, 1994; Blakemore *et al.*, 2010).

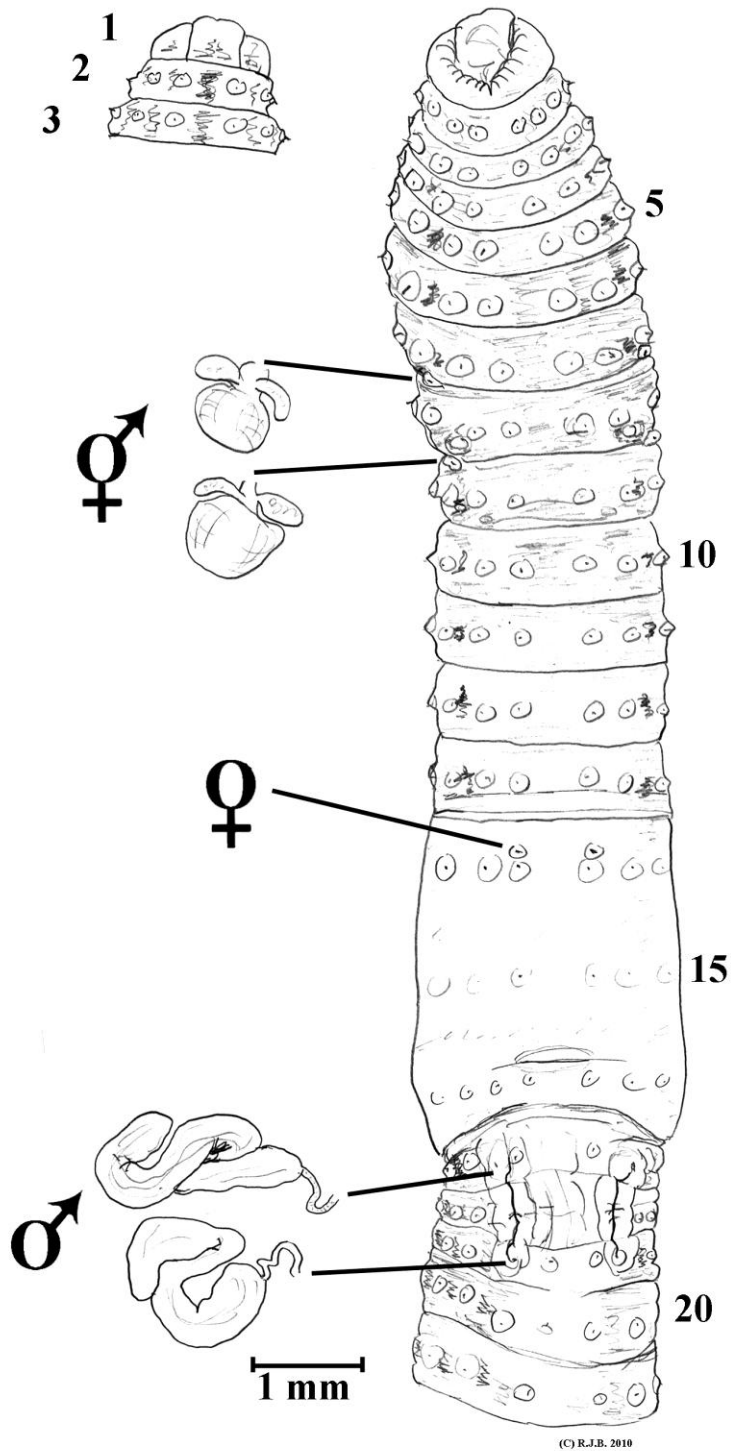
**References** (For brevity, not all earlier taxonomic citations are provided here).

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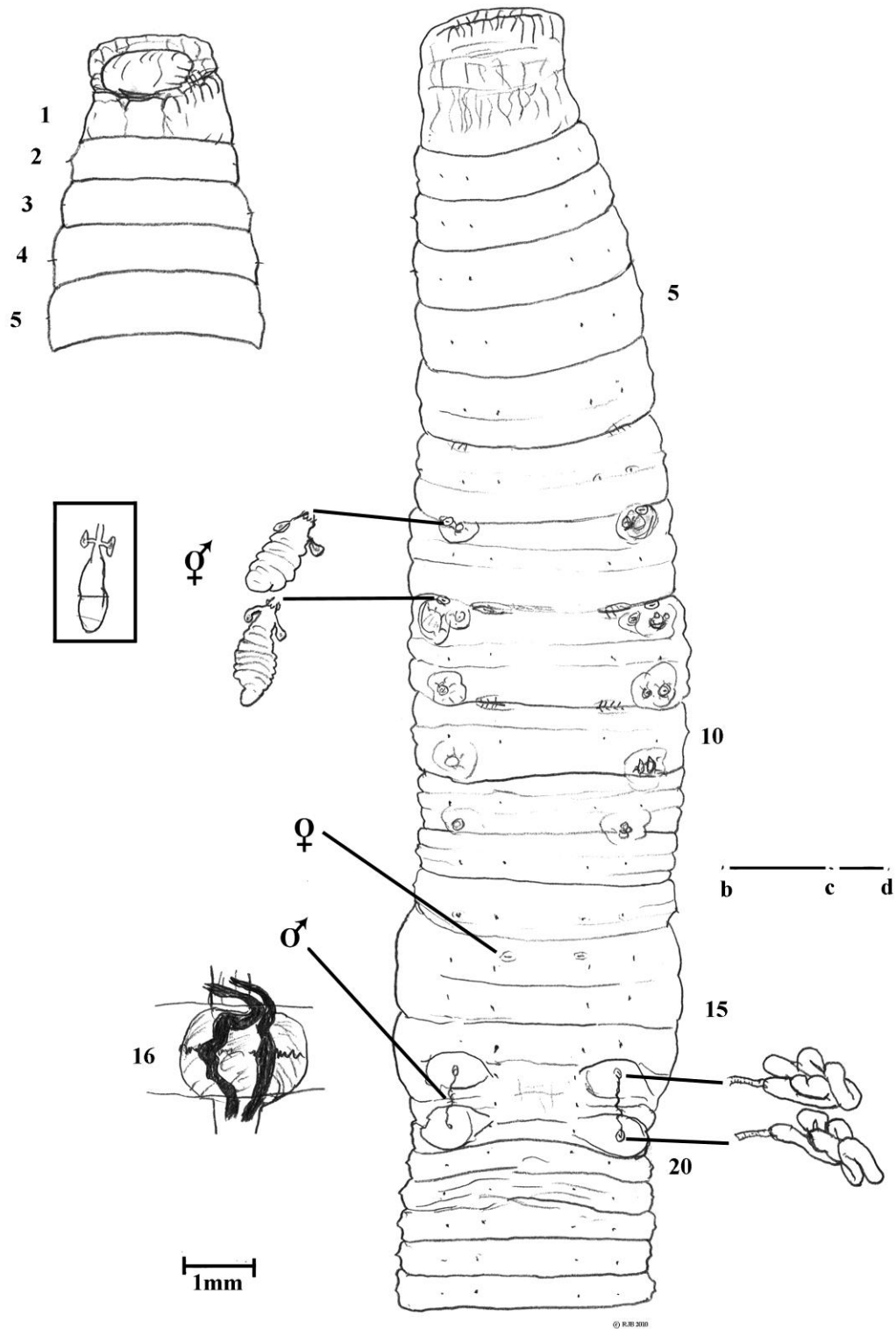
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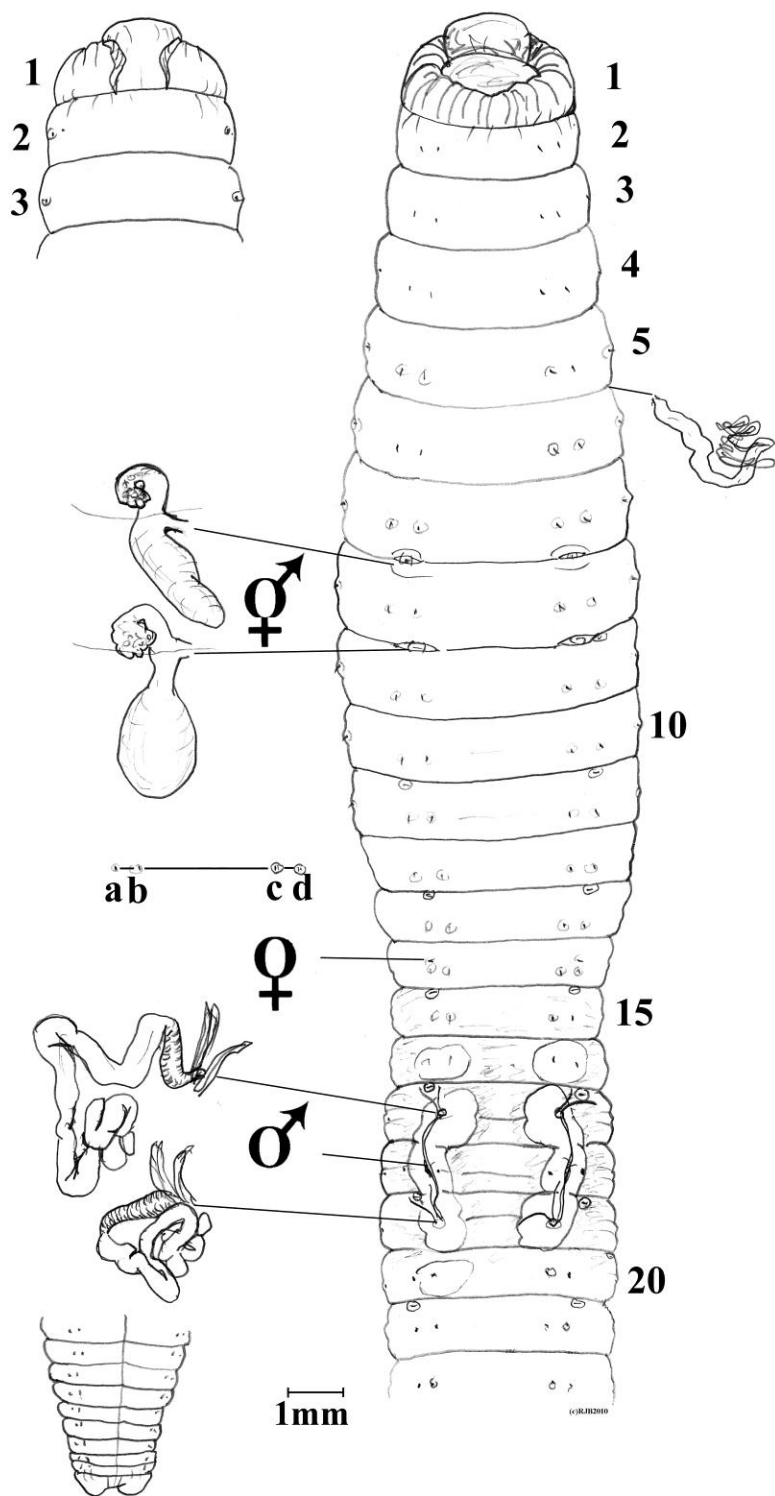
*Decachaetus erici*

Fig. 1.



*Diploptrema bilboi*

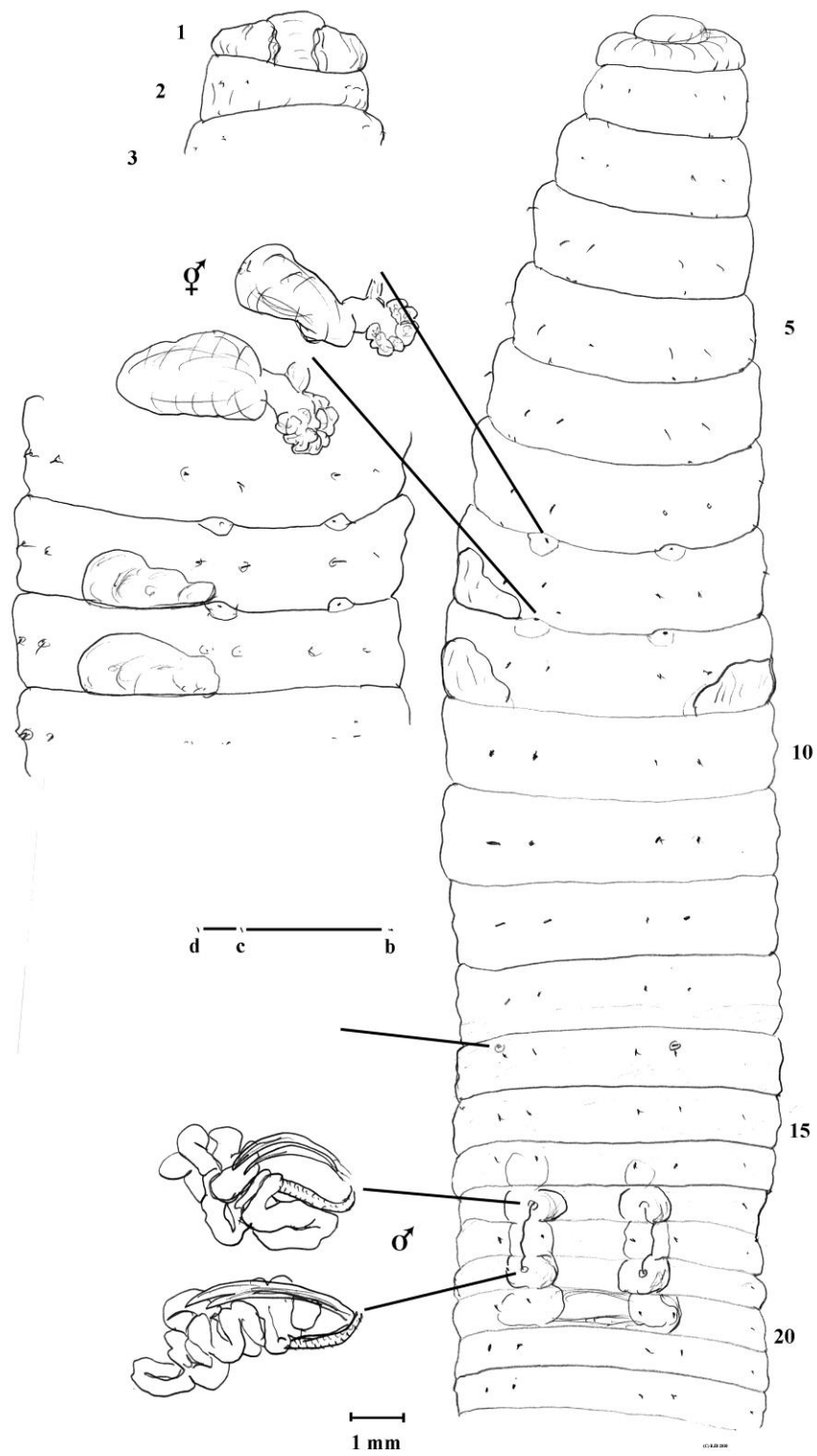
Fig. 2.



*Maoridrilus felix*

su

Fig. 3.



*Maoridrilus suteri ama*

**Fig. 4.**

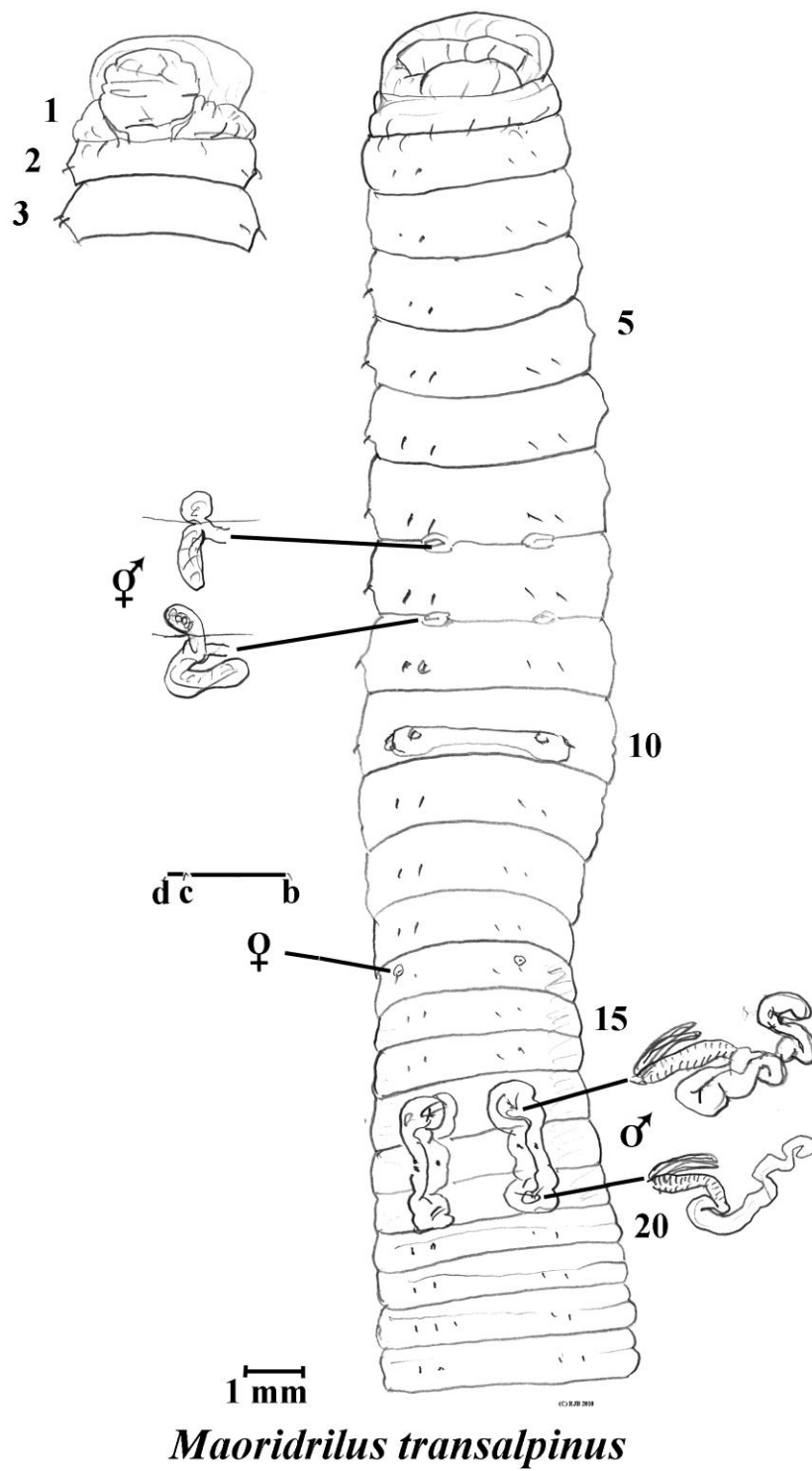
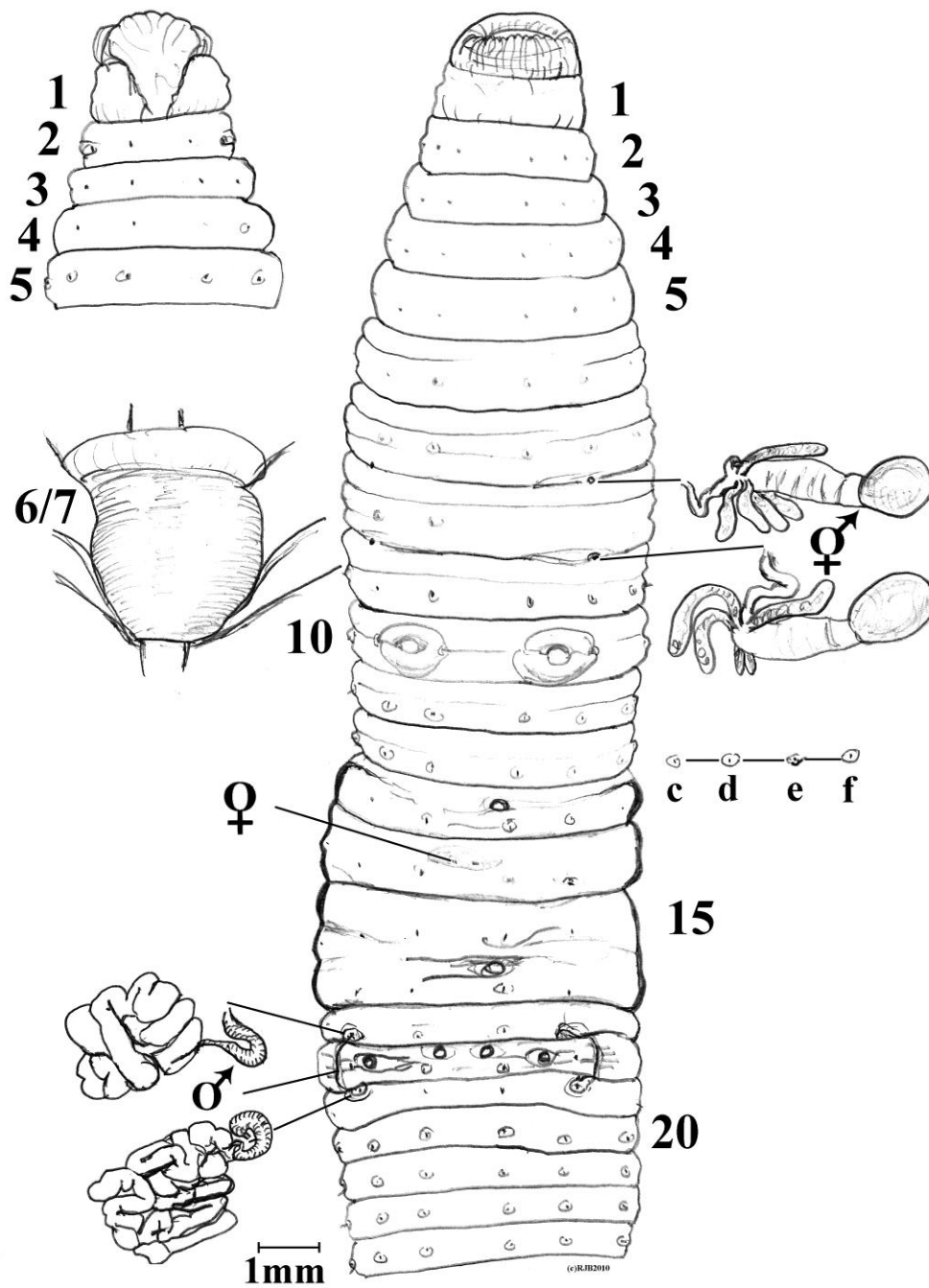
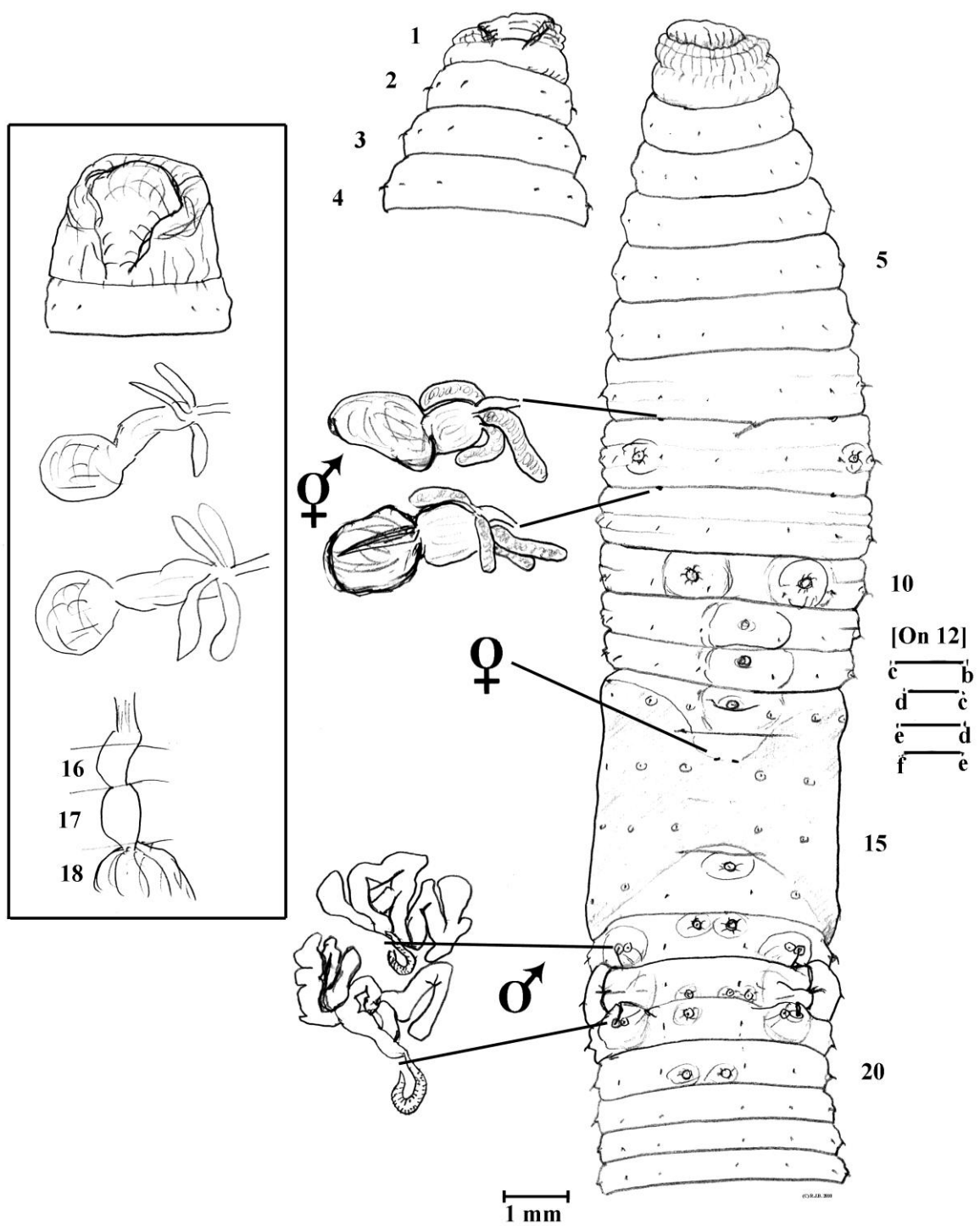


Fig. 5.



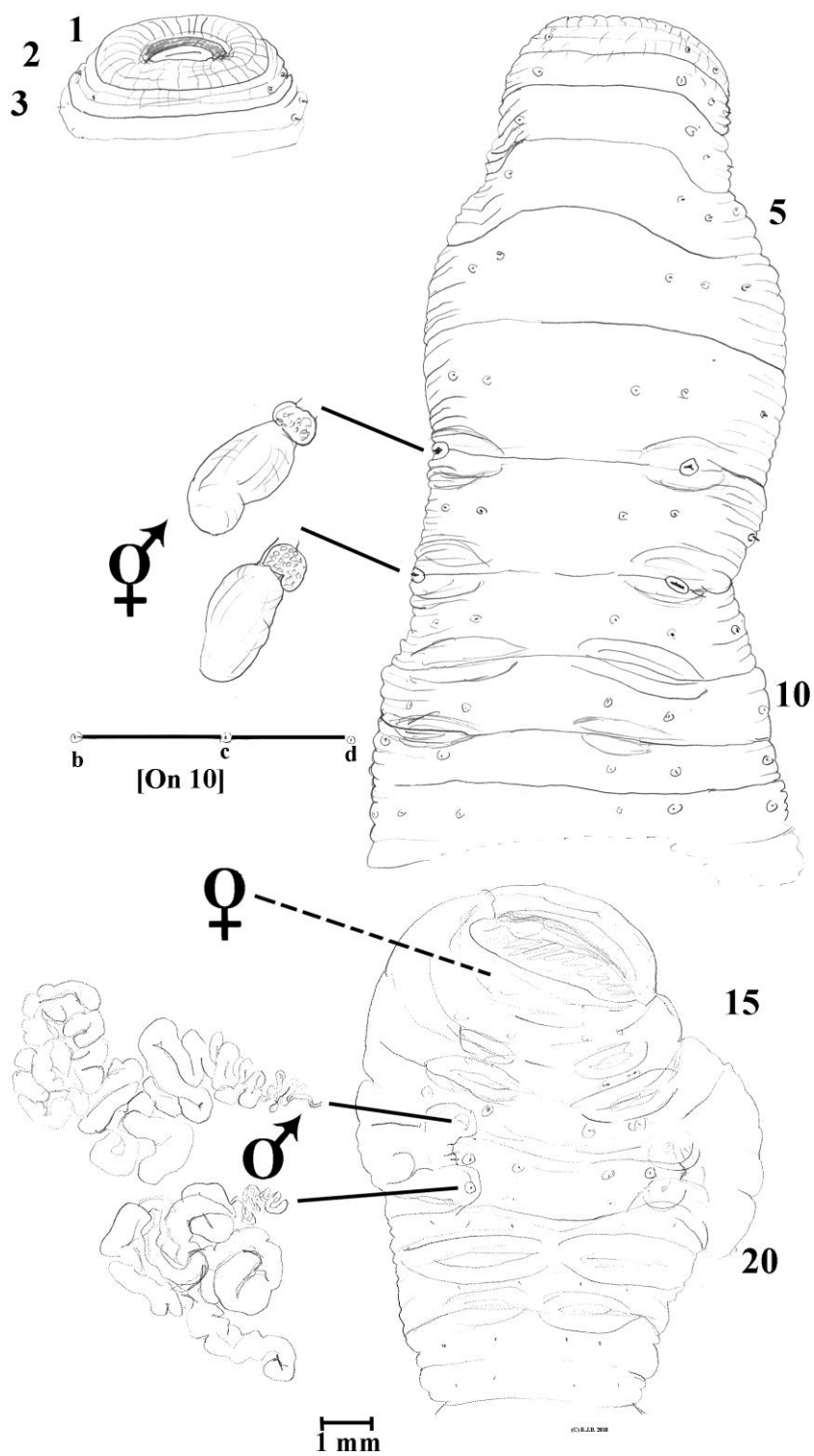
*Deinodrillus gorgon*

Fig. 6.



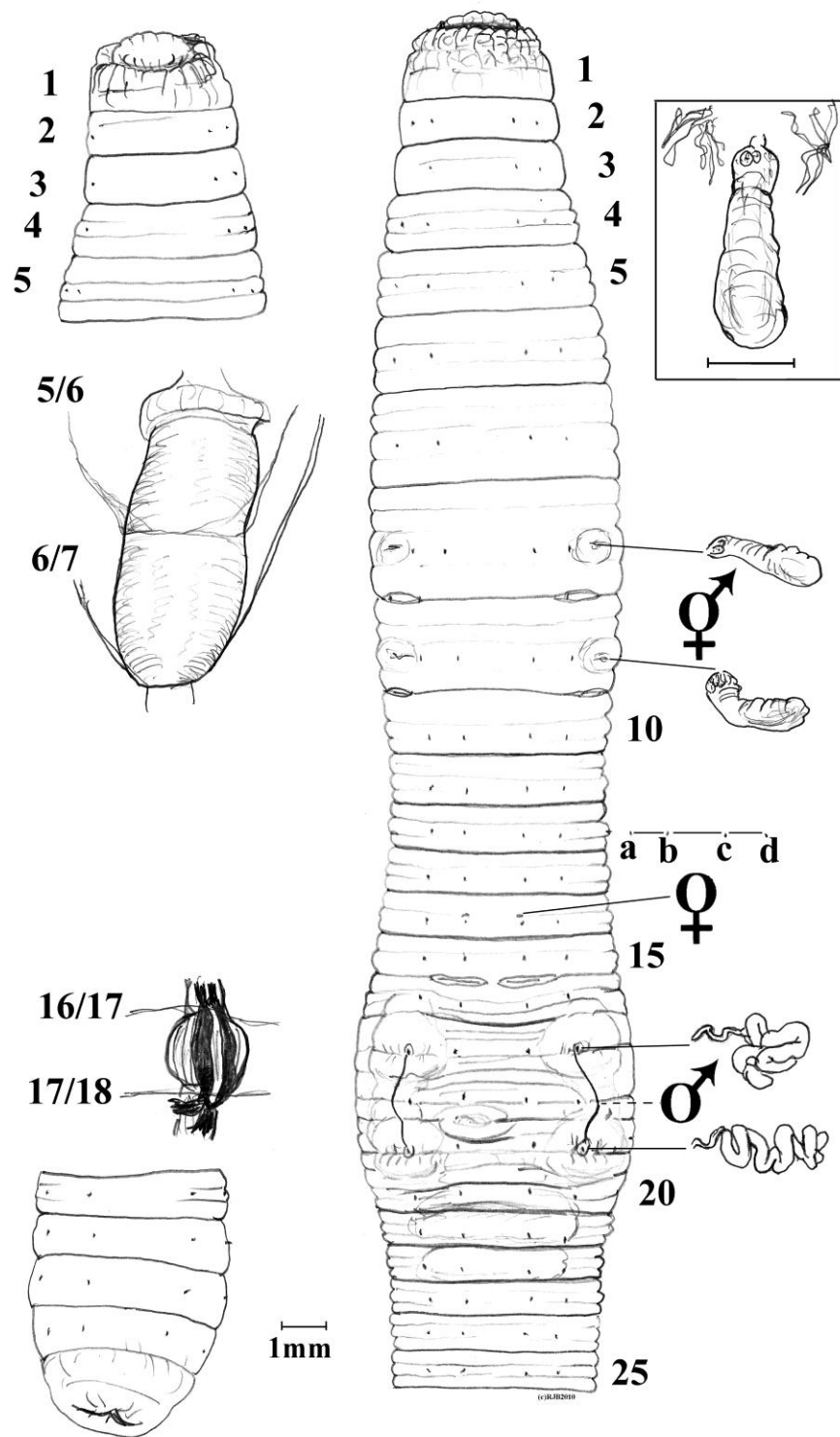
*Deinodrilus medusa*

Fig. 7.



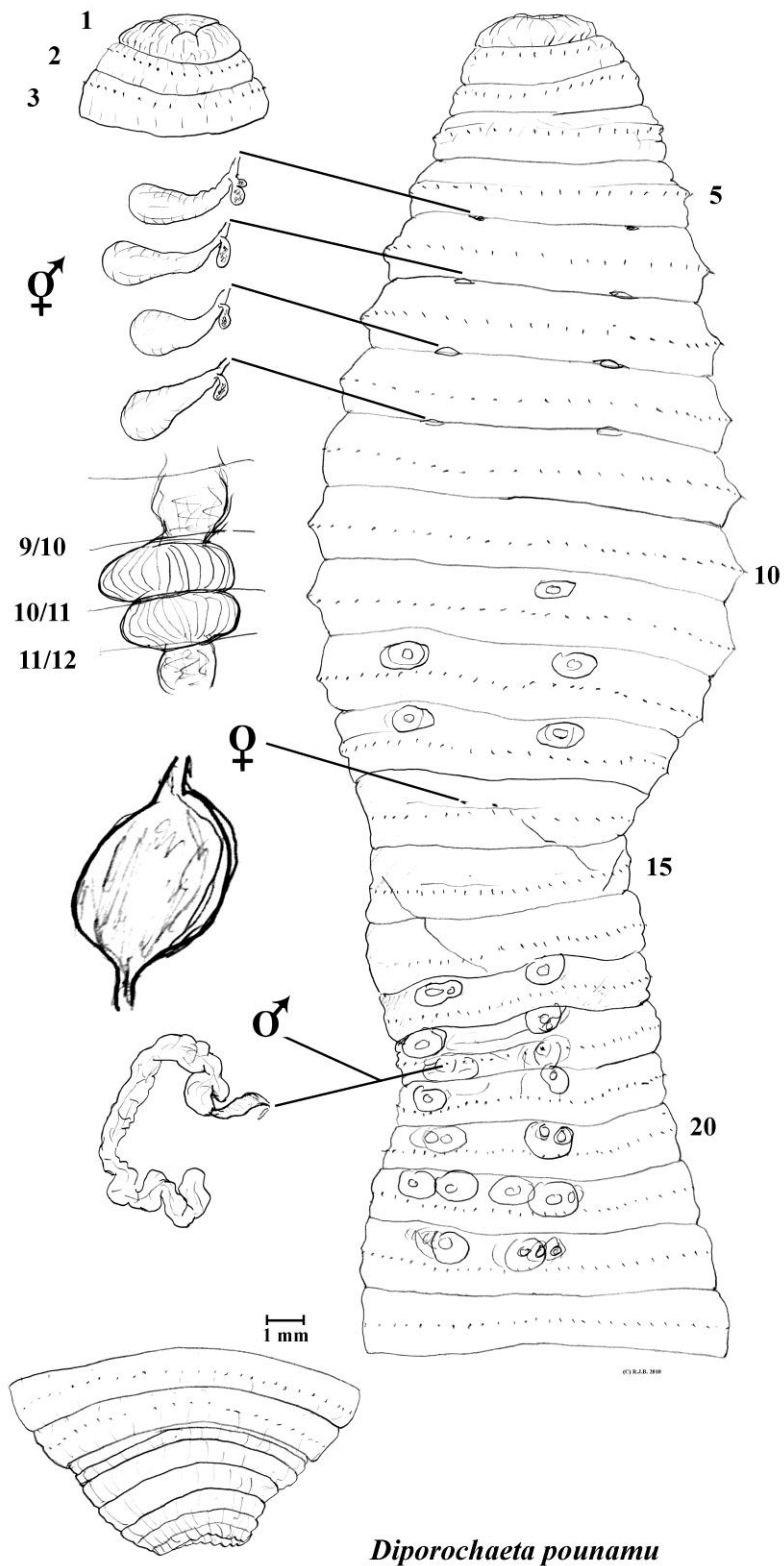
*Octochaetus diememoratio*

Fig. 8.



*Octochaetus kenleei*

Fig. 9.



*Diporochaeta pounamu*

Fig. 10.

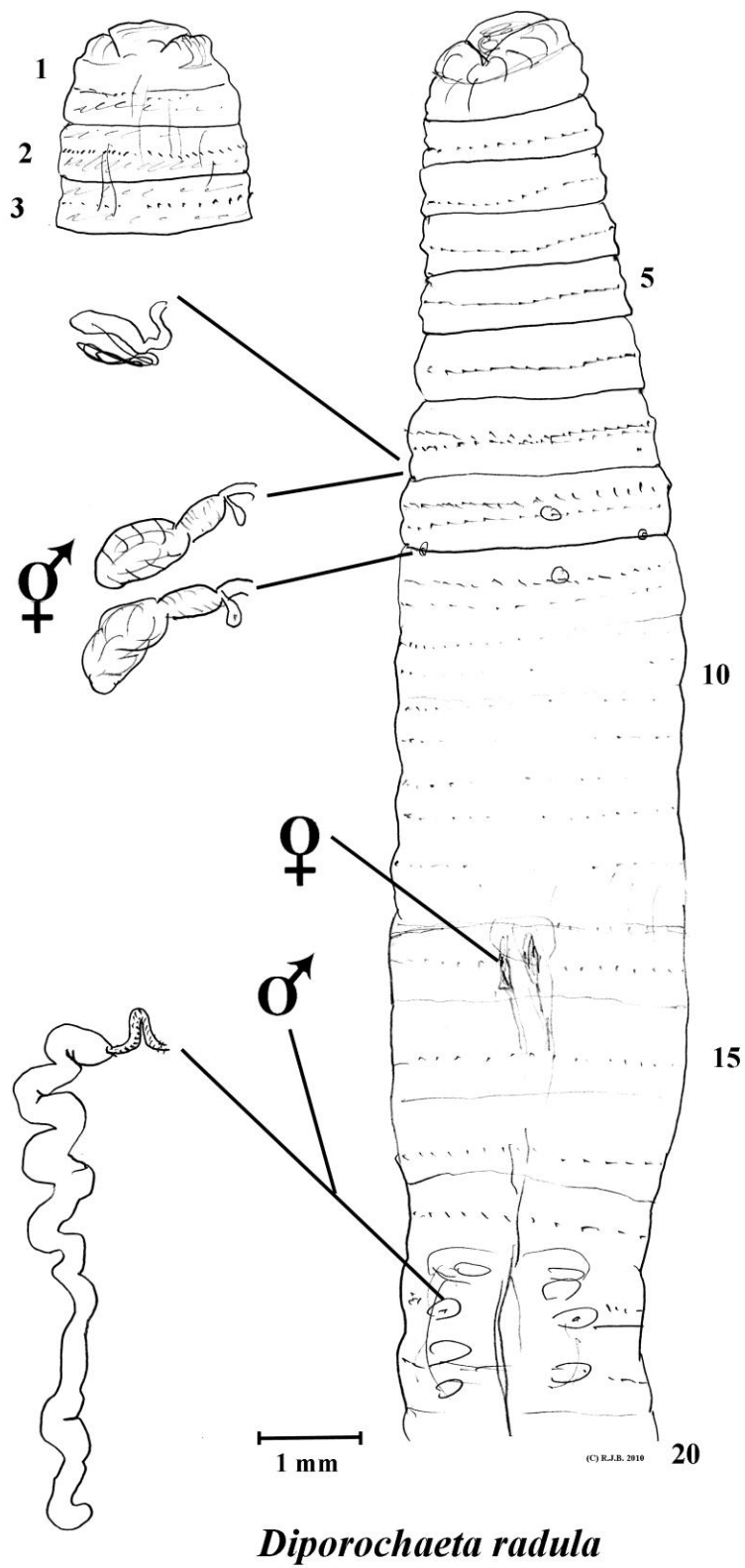


Fig. 11.

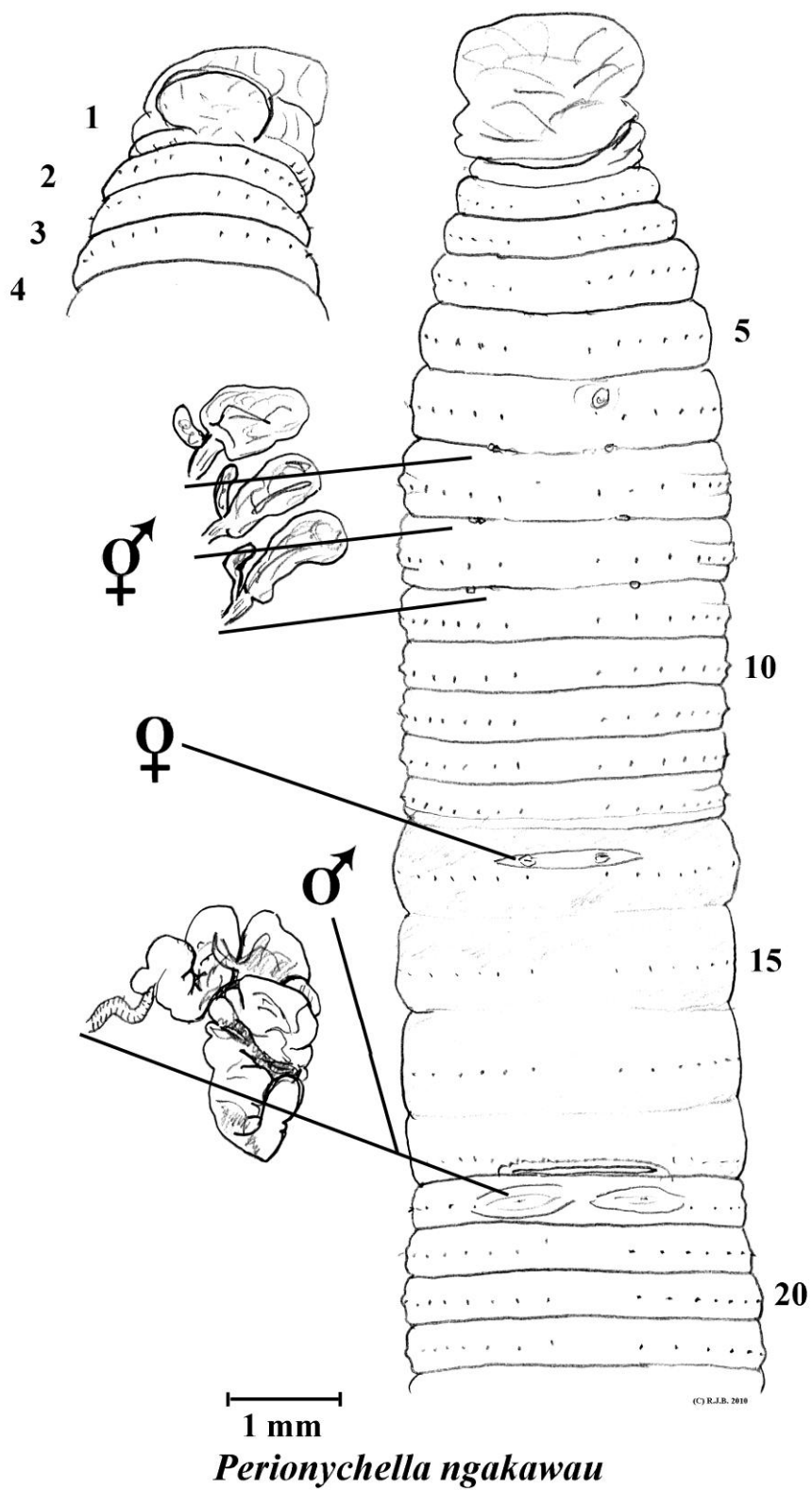
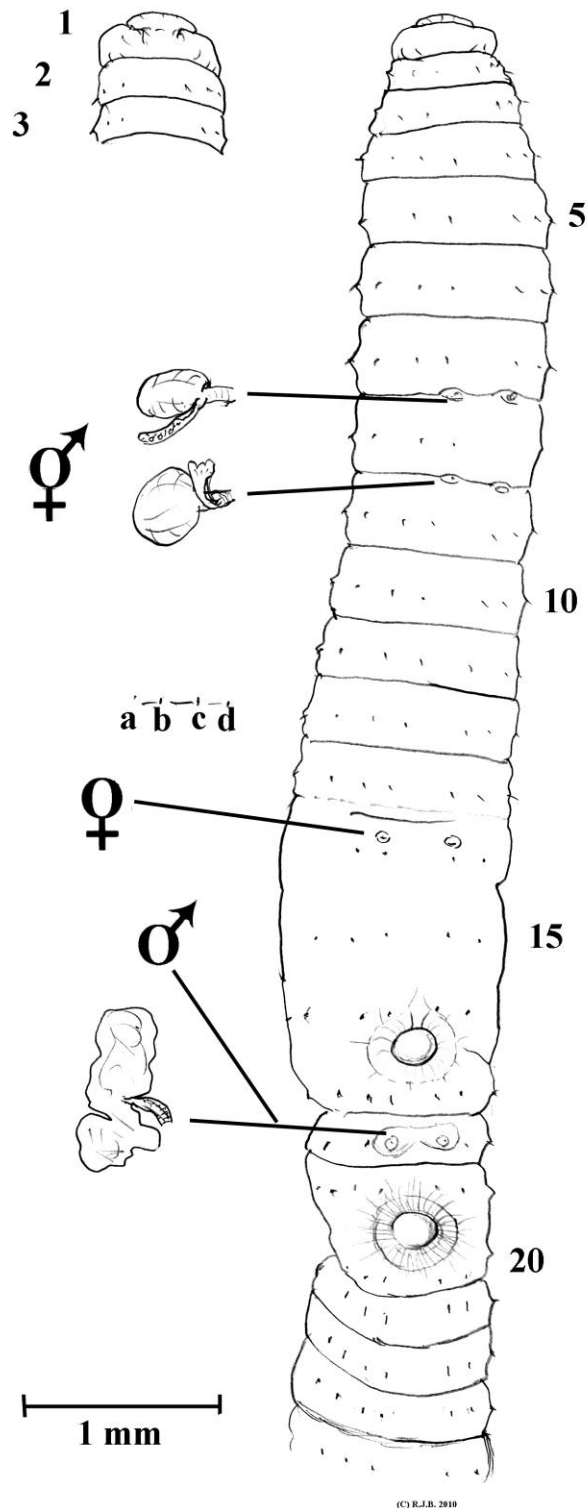


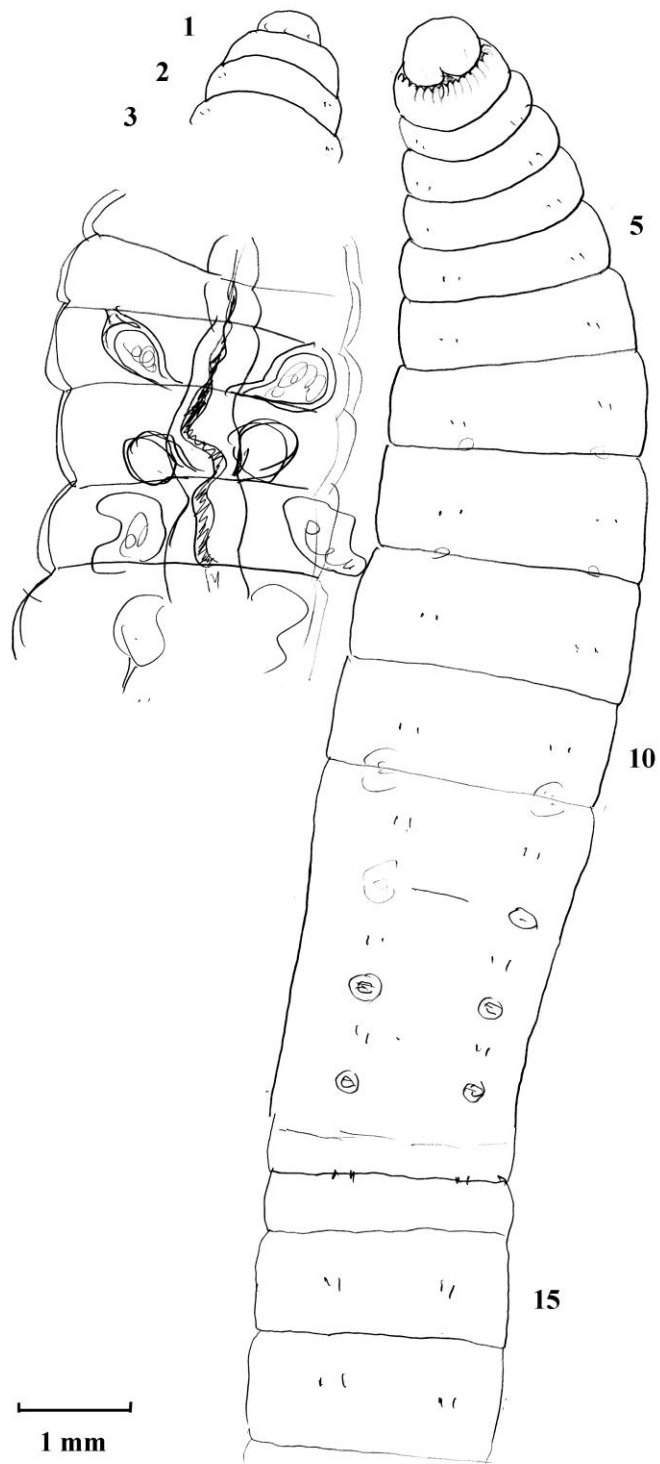
Fig. 12.



(C) R.J.B. 2010

*Zacharius obo*

Fig. 13.



**Unidentified microdrile**

**Fig. 14.**

## Appendix 1

### **GenBank submissions for some new NZ species**

mtDNA COI extraction and sequencing conducted by S. Boyer on tissue samples provided by R. Blakemore from specimens taxonomically identified in Tokyo.

*M. felix* (H) COI, GenBank accession number HQ529282 (submitted 01 November 2010)

*D. gorgon* (H) COI, GenBank accession number HQ529284 (submitted 01 Nov. 2010)

*O. kenleei* (H) COI, GenBank accession number HQ529283 (submitted 01 Nov. 2010).

Other DNA analyses, conducted by S. Boyer and R. Blakemore on tissue samples from species identified and with tissue samples extracted by R. Blakemore are pending. Taxonomic naming of specimens is the first step to understanding the Ecology of a species, its ecosystem functioning, conservation etc. and, now that these species are formally named, rather than having mere Accession or Voucher Numbers, their phylogenetic relationships and molecular information may be readily analysed further using their universal and unique identifier: i.e., their binomial Linnaean Scientific name. Especially important is to sample from primary types, as was previously advocated and exemplified by Blakemore *et al.* (2010) in the first ever example of DNA analysis of an earthworm's type specimen.

## Appendix 2

### **Preservation of Earthworms using Propylene Glycol alternative to Ethanol/Formol**

Specimens were sent to R. Blakemore at Tokyo National Museum from Lincoln University, New Zealand by S. Boyer. They were fixed and then preserved in propylene glycol for transportation with these apparent benefits over formalin and ethyl alcohol:

1. Sending via courier or mail permitted (i.e. not toxic nor flammable).
2. Carriage via aircraft apparently not as regulated/restricted.
3. Passable through quarantine (Australia/NZ) as in an “alcohol” preservative.
4. Morphology and extractable DNA were well preserved (COI data given herein) and see also Leal-Klevezas *et al.* (2000) and this blog: <http://evol.mcmaster.ca/~brian/evoldir/Answers/InsectDNA.preservation.answers>.
5. Non-toxic (cf. formalin or alcohol) to eco-taxonomist, collecting, dissecting and identifying specimens nor to curators and technicians.
6. Volatilization less than other alcohol over the long term, thus better storage.
7. Non corrosive to most containers.
8. Possibly the same sweet liquid was used to preserve ANIC specimens of Stockholm types #123, 135, 137, & 146 for *Notiodrilus bovei* & *Octochaetus fermani* of Rosa & Michaelsen from South America that were mostly collected in 1895 as listed in Register by Blakemore (1995, 2007) and, if so, then the long-term preservation of morphological features is excellent, as was noted at the time in that spreadsheet.

Additional chemical eco-toxicological data available here:

<http://www.jtbaker.com/msds/englishhtml/p6928.htm>.

### Appendix 3

#### Location of Primary Type listed as missing by Marshall (2005)

Sixteen primary types of species collected and described by Lee (1959) were listed by Marshall (2005: 53) as absent after transfer and receipt by the Te Papa museum from the Dominion Museum in early 1966. In addition, Marshall listed two other of Lee's earthworm species that were missing from the collection, either initially or subsequently.

A catalogue by Blakemore (1995, 2007) lists the following material as being deposited/dumped at ANIC by a Dr Geoff Dyne following his 1985 Queensland University PhD studies. It is not known where Dyne obtained these samples initially, but it seems from Marshall's (2005) report that at least *Octochaetus brucei* has been missing from the 1960s. Apparently this specimen has either not been returned, not received, or its return was not recorded. The pertinent extract from the Register Blakemore (1995, 2007) is presented below:

Species	Author/ status	Locality	Collector	Date	Habitat	Type	Id	Pres	No.	Collection	Notes
<i>various spp</i>	K.E.Lee	New Zealand	K.E.Lee	1949-51		TYPES?	KEL	80% alc	60	11 glass jars from Dominion Museum Wellington, N.Z.	Need to return to NZ...
<i>Octochaetus brucei</i>	K.E.Lee	New Zealand	A.C.S.Wright	1.ii.1951	ex forest Mokai Patea, 3700 ft, Field No. 623	TYPES?	KEL	80% alc	61	From Dominion Museum, Wellington	Need to return to NZ

Specimen/label data details collected by the author (at ANIC Canberra on 15<sup>th</sup> May, 1995) from my previously unpublished curatorial notebook follow. Sample #60 comprised 11 glass jars with plastic lids from Dominion Museum Wellington (DMW); sample #61 was in a larger jar. Specimen data reported below has Te Papa registration [in square braces] from Marshall (2005) wherein "*Missing type material is also listed*":

- *Hoplochaetina pallida* Lee ex scrub, Matakoho. Coll: K.E. Lee 25.7.51 Field No. 649 DMW 565. [W.519]
- *Leucodrilus fuscus* Lee ex bush remnant, Wairoa. Coll: K.E. Lee 25.11.49 Field No. 254 DMW 823. [W.482].

- *Octochaetus thomasi* Bedd. ex tussock Dacre. Coll: K.E. Lee 7.3.58 Field No. 1391 DMW 414.
- *Hoplochaetina subtilis* Lee ex scrub Tinopai. Coll: K.E. Lee 27.7.51 Field No. 645 DMW 554. [W.500].
- *Octochaetus tricystis* Lee ex forest, Hunterville. Coll: K.E.L. 11.5.50 Field No. 386 DMW 365. [W.514].
- *Octochaetus sylvestris* ex native bush Raukawa. Coll: K.E.L. 6.7.49 Field No. 128 DMW 281. [W.535].
- *Hoplochaetina rossi* Benh. under log Stillwater Caswell Sound. Coll: R. Forster 12.4.49 Field No. 916[?] DMW 916.
- *Octochaetus huttoni* Bedd. mouth of Angus Burn W. Southland. Coll: A.C.S. Wright 13.1.49 Lab. No. 41/49 D.M.W. 308.
- *Hoplochaetina polycystis* Lee ex scrubland Kaitaia. Coll: K.E.L. 23.3.49 Field No. 47 DMW 319. [W542].
- *Octochaetus michaelsoni* ex forest, Waiorongomai. Coll: K.E. Lee 19.4.50 Field No. 354 DMW 406.
- *Octochaetus kapitiensis* Lee ex forest Kapiti Is. Coll: K.E. Lee 26.1.5.. Field No. 1113 DMW 269. [W.503 – this species apparently missed from the Te Papa Collections Online website <http://collections.tepapa.govt.nz/Search.aspx?view=list&term=Acanthodrilidae> Accessed Dec. 2010].
- *Octochaetus brucei* Lee ex forest Mokai Patea 3700ft.. Coll: A.C.S. Wright 1.2.51. Field No. 623 DMW 998. [Listed as missing in Marshal ([2005](#))].

Several other types listed by Lee (1959) as being deposited in the Canterbury Museum, Christchurch are no longer lodged there and are thought transferred to Te Papa (pers. comms. Dr Simon D Pollard and Peter Johns, Curators of Invertebrate Zoology at Christchurch). However, at least some of Lee's material lodged in the Otago Museum still exists in Dunedin (Cody Fraser pers. comm.). Thanks go to John Marris, curator of Lincoln Uni. Museum for pointers to these curatorial contacts at other institutions.

## **Appendix 4**

### **Applications for funding support for New Zealand earthworm Guide RJB (2000).**

The author's two unadulterated files are:

[NZ Earthworm Proposal RTF.rtf](#) 5/04/2000 6:18 PM

[Guts of NZ proposal.rtf](#) 5/04/2000 8:03 PM:

“

### **PROPOSAL**

#### **Provisional title of book (including any subtitle)**

A Lucid Guide to the Earthworms of New Zealand.

#### **Subject of the book (attach a draft Table of Contents and synopsis of each chapter if possible)**

A lucID (computerized interactive key) guide to the 192 earthworm species reported from New Zealand. The guide would provide instruction on what characters are needed to identify earthworms and would lead offer a progressive range of choices so that the correct answer is arrived at. Species descriptions would be accompanied by notes and references on what is known of the ecology, economic importance, and distributional range of the earthworm concerned. The format of the guide would follow that of the definitive work on NZ earthworms: Lee, K.E. (1959). The Earthworm Fauna of New Zealand. Bulletin 130, DSIR, Wellington.

Purpose of the book. Please provide about 200 words that explain why the book is needed and how the book will benefit its readers.

Earthworms are important mediators and monitors of terrestrial ecosystems due to their ancient and intimate association with soils and soil fertility. The guide aims to update and supercede previous work on NZ earthworms, incorporating all the information that has accumulated in the 40 years since publication of Lee's book. Like Australia, New Zealand has a rich and unique native fauna (of which next to nothing is known), complemented by a suite of exotic species that are more commonly encountered in garden, cultivated and pastoral soils. Earthworms in general are vitally important for sustainable primary production. New Zealand farmers and researchers were World pioneers from the 1930's in introduction and enhancement of earthworms in order to increase agricultural productivity. It was suggested that the most economic option open to farmers was to encourage earthworms in their fields. Exotic species are also important in the waste management and recycling industries using vermicomposting techniques. Conservation issues arising from the encroachment of exotics onto native lands is a further important consideration. In all situation being able to correctly identify and reference the particular species involved is an essential first

step, not only to understanding their ecological reality, but also for assessment of their economic potential. The guide would provide an enabling tool to this end for all workers: from novice to more experienced taxonomist. (NZ has a national strategy to be wholly organic in agricultural production by the year 2020, in which case earthworm activity in soils would assume even greater importance).

Audience for the book, including use for teaching, research, professional, etc.

(a) Primary audience:

Academics, researchers and students at universities (7 of) and polytechnics (several), agricultural research institutions, museums, state libraries and schools (several hundred).

Students from primary to tertiary level would be interested in such a guide (according to Dr. P. Fraser).

(b) Secondary audience:

Farmers, graziers, horticulturalists, vermiculturalists, gardeners, waste managers, nature conservators, educators and those with general natural history interest.

Competing publications. Please list title, author, price and publisher if possible and explain how your book will be superior to them

Lee, K.E. (1959). The Earthworm Fauna of New Zealand. Bulletin 130, DSIR, Wellington. Pp 486. Price when published, 3 pounds. [Approximately 1,000 copies were produced and this book is now out of print].

Lee, K.E. (1959). A Key for the Identification of New Zealand Earthworms. Tuatara, VIII(1): 13-60. [Dr Ken Lee tells me he also had 500 reprints of this Key which he passed on the various researcher and other interested parties over the years].

There are several popular booklets or fact sheets (eg. Amy Brown's books and Nick Martin's papers) on the subject, but much of the information they contain is outdated, unreliable and incomplete; so in effect there is no "competing publication" and a definite void exists.

Please list (in order of importance) the countries in which the major sales of your book will be expected

Primarily New Zealand.

Please give a realistic estimate of sales (i.e. how many copies do you expect will sell?)

Print run of 1,000 should sell initially, if pitched at the 'right' price.

Expected life of the book. Would you expect it to justify a revised edition?

Such a book would possibly revitalize study and interest in this important group, and revisions could be expected from time to time.

Expected size of book. Allow 500 words per page, including indexes and appendices

Ca. 300 pages.

Approximate number of illustrations

- (a) Diagrams - ca. 200 figures and maps [most from Lee (1959)].
- (b) Photographs – several.
- (c) Colour – several.

Expected date of delivery of the final manuscript:

Sometime in 2001 if financial support is obtained now.

In collaboration with the other authors (Ken Lee and Trish Fraser), I have already revised the taxonomy of the whole New Zealand earthworm fauna for a joint paper currently in press. Dr Fraser believes we can secure some financial contribution, at least from NZ Department of Conservation and Royal Society, towards the guide. This is a preliminary enquiry to determine whether the project, unlike the subject, has legs.  
”

## Appendix 5

### Checklist of New Zealand Earthworms updated from Lee (1959)

by R.J. Blakemore December, 2010

National Museum of Nature and Science, Tokyo, Japan.

#### Introduction

This taxonomic review is based on Blakemore (2004) that updated the work completed nearly 50 years earlier by Lee (1959) as modified by Blakemore in Lee *et al.*, (2000) and in Glasby *et al.* (2007/8) based on the information presented at the "Species 2000" meeting held Jan. 2000 at Te Papa Museum in Wellington, New Zealand. In the current checklist Acanthodrilidae, Octochaetidae and Megascolecidae sensu Blakemore (2000b) are all given separate family status. Whereas the excellent work by Lee (1959) listed approximately 193 species, the current list has about 212 taxa with some names removed and several others added, as noted below.

Because many of the natives have few reports, or are based on only a few specimens, approximately 77 are automatically listed as "threatened" or "endangered" in Dept. Conservation threatened species list (see [www.doc.govt.nz/Conservation/001~Plants-and-Animals/006~Threatened-species/Terrestrial-invertebrate-\(part-one\).asp](http://www.doc.govt.nz/Conservation/001~Plants-and-Animals/006~Threatened-species/Terrestrial-invertebrate-(part-one).asp) April, 2005) and three species are detailed in McGuinness (2001). Further studies such as those of Springett & Grey (1998) are required. Currently I seek funding to complete my database into an interactive guide to species, to use to conduct surveys in New Zealand.

Some of the changes in Blakemore (2004) and subsequently from Lee (1959) are:

- *Microscolex macquariensis* (Beddard, 1896) is removed from the list because it is known only from Macquarie Island, which is now claimed as Australian territory (see Blakemore, 2000b).
- *Megascolides orthostichon* (Schmarda, 1861) is removed from the fauna as Fletcher (1886: 524) reported that "on the authority of Captain Hutton" this species was not from New Zealand and may be from Mt Wellington in Tasmania (see Blakemore, 2000b).

- *Didymogaster sylvatica* Fletcher is provisionally retained although this distinctive blue Australian species has not been re-confirmed from New Zealand.
- *Rhododrilus* Beddard is primarily a New Zealand genus although introduced and possibly neoendemic species are also found in Tasmania and Australia where *Kayarmacia* Jamieson is a new junior synonym.
- Because *Rhododrilus disparatus* Lee is meroic it is transferred as a new combination in *Leucodrilus* Lee.
- *Octochaetus* was recently found to have both exotic (see Blakemore, 1999) and native (see Blakemore, 2000b) Australian representatives, e.g. the native *O. ambrosensis* (Blakemore, 1997) in Queensland where *Neodiplotrema* Dyne is a new junior synonym.
- *Eudinodriloides* Lee and *Sylvodrilus* Lee are retained but it is noted that these genera are perichaetine and anisochaetine, respectively, rather than lumbricine.
- *Plutellus* Perrier species are transferred to *Graliophilus* Jamieson which is believed to have tubular prostates in its type species (originally described as “flattened tubes”).
- After Easton (1984), *Pontodrilus matsushimensis chathamianus* Michaelsen is in synonymy of *Pontodrilus litoralis* (Grube) and this genus is now included in Megascolecidae s. Blakemore, 2000b.
- *Megascolides* McCoy is retained, although species with non-tubular prostates are returned or reallocated to *Notoscolex* Fletcher, for which its junior synonym are: *Tokea* Benham, 1904; ?*Nellosclex* Gates, 1939; ?*Lennosclex* Gates, 1960; *Pseudonotoscolex* Jamieson, 1971; *Pseudocryptodrilus* : Jamieson, 1974, 2000 (part.) cf. *Megascolides*; *Oreoscolex* Jamieson, 1973; *Araucaridrilus*, Jamieson, 2000; ?*Plutelloides* Jamieson, 2000 (but cf. *Megascolides*) – syns from Blakemore (2000; 2005; 2006). Classical genus lacking nephridial bladders, cf. *Cryptodrilus*.
- Endemic *Perionyx* Perrier species are transferred to *Perionychella* Michaelsen as originally defined, for which *Terriswalkerius*

Jamieson is a junior synonym (see Blakemore, 2000b).

- *Diporochaeta* Beddard is retained with its original definition [includes *Terriswalkerius* Jamieson (part.)].
- *Megascolex* species from Australia and New Zealand are now placed in *Anisochaeta* Beddard, for which *Trichaeta* Spencer, *Spenceriella* Michaelsen, *Gemascolex* Edmonds and Jamieson, *Pericryptodrilus* and *Prophetima* Jamieson are junior synonyms (see Blakemore, 1997, 2000a, 2002, 2005).
- *Anisochaeta laingii* (Benham) from Norfolk Island was restored from synonym by Blakemore (1997: 1842), it is retained as it was reported from Hamilton, NZ.
- Species that have tubular prostates and previously placed in *Spenceriella* Michaelsen (the neotype of which was stated by Jamieson to have racemose prostates, although this is possibly a mistake - see Blakemore, 1997: 1823) are now in the next available genus, *Celeriella* Gates for which *Pericryptodrilus* Jamieson, 1977 would be a synonym if the prostates are indeed "thickly or flattened tubular" as claimed (but as they appear tubuloracemose then this name belongs in *Anisochaeta*). This is primarily an Indian genus and it is probable that such New Zealand species will eventually be placed in a separate genus.
- Following Lee (1962), *Spenceriella shakespeari* (Benham) is made a junior synonym of *Megascolex antarcticus* Baird which is transferred to *Celeriella* Gates as a new combination.
- The nomenclature of alien megascolecids and lumbricids is updated to mostly comply with Sims and Gerard (1985; 1999) and Blakemore (2002 and 2004).
- Sims & Gerard's (1985; 1999: 48) report of *Bimastos parvus* from NZ is unsubstantiated and is likely confusion with one of the natives named "*parvus*".
- *Dichogaster godeffroyi* (Michaelsen, 1890) [now = *Eutrigaster (Graffia) godeffroyi*] from Haiti (Puerto Plata) had a New Zealand report that was considered undoubtedly incorrect by Michaelsen (1900: 354).

- *Eudrilus eugeniae* Kinberg, 1867 report from New Zealand was similarly dismissed by Lee (1959: 356) (see Blakemore, 2002).
- *Pontoscolex corethrurus* (Müller), *Amyntas gracilis* (Kinberg) and *Amyntas hupeiensis* (Michaelsen) are added to the NZ alien species list following extensive searches of literature by the current author. These were from reports by Michaelsen (1900: 425) who lists *Pontoscolex corethrurus* from NZ; Easton (1981: 53) who reports *Amyntas hupeiensis* from NZ; and Easton (1984: 118) who records *Amyntas gracilis* and *Amyntas corticis* from Raoul Id. (where it was previously identified as *Pheretima clerica* Benham, 1947 and as *Pheretima campestris* Lee, 1952 [this latter taxon was placed in synonymy of *Perichaeta peregrina* Fletcher, 1887 (= *Amyntas corticis*) by Lee (1959: 327) as confirmed by Sims & Easton (1972: 234), nevertheless an unnecessary substitute name *Pheretima medicampestris* Nakamura, 1999 was provided for Lee's species as a homonym of *Perichaeta campestris* Goto and Hatai, 1898 (= *Amyntas robustus*). Under ICZN (1999: Art. 60) this secondary junior homonymy replacement name is unnecessary and invalid since available and valid synonyms exist for the taxon].
- *Perionyx excavatus* Perrier, 1872 and *Dendrobaena veneta* (Rosa, 1886) were identified by the current author in 2001 and 2002 from material sent by Dr Trish Fraser from NZ wormgrowers (see <http://www.crop.cri.nz/home/news/archives/2002/A1035335475.htm> Feb. 2005).
- *Octolasion tyrtaeum tyrtaeum* (Savigny, 1926) is a new record, collected 12<sup>th</sup> Nov., 2010 by RJB from near a beach at Greymouth.

About 212 species are already described; but how many species are there in total in New Zealand? Tasmania which at 67,800 Km<sup>2</sup> is about one quarter the size of New Zealand (267,000 Km<sup>2</sup>), has 229 species in 38 genera belonging to 4 families comprising: 202 natives (in 24 genera), 1 neo-endemic species (from Subantarctic Macquarie Island), 23 exotics and 3 translocated mainland species (Blakemore, 2000; 2004; 2005). If New Zealand has a similar diversity then the total would be about 4 times as large, about 900 species. However much of the north island is volcanic and the south island is alpine, so less area is available for earthworm colonization and perhaps we can anticipate a somewhat lesser species total.

**Table of New Zealand Phylum Annelida Subphylum Clitellata Class Oligochaeta Order Haplotaxida Suborder Lumbricina (of Sims and Gerard, 1999); families after Blakemore (2000a,b; 2002) and following recommendations of ICZN (1999)**

<b>FAMILY/Genus</b>	<i>Species name</i>	<b>Author (genus author in bold)</b>	<b>Synonyms for native species and (some) genera, plus specific status</b>	<b>Code*</b>
<b>ACANTHODRILIDAE</b>				
<b><i>Acanthodrilus</i></b>		<b>Perrier, 1872</b>	<i>Notiodrilus</i> (part. inc. type?) Michaelsen, 1899; <i>Eodrilus</i> (part. not type) Michaelsen, 1907	
<i>Acanthodrilus</i>	<i>kermadecensis</i>	Lee, 1953		<b>EK</b>
<b><i>Decachaetus</i></b>		<b>Lee, 1959</b>	<i>Eudinodriloides</i> Lee, 1959	
<i>Decachaetus</i>	<i>erici</i>	Blakemore, 2010		<b>E</b>
<i>Decachaetus</i>	<i>forsteri</i>	(Lee, 1959)		<b>E</b>
<i>Decachaetus</i>	<i>minor</i>	Lee, 1959		<b>E</b>
<i>Decachaetus</i>	<i>violaceus</i>	Lee, 1959		<b>E</b>
<b><i>Dinodriloides</i></b>		<b>Benham, 1904</b>		
<i>Dinodriloides</i>	<i>beddardi</i>	Benham, 1904	<i>Dinodriloides annectens</i> Benham, 1906	<b>E</b>
<b><i>Diplorema</i></b>		<b>Spencer, 1900</b>	<i>Notiodrilus</i> (part. not type) Michaelsen, 1899; <i>Eodrilus</i> Michaelsen, 1907	
<i>Diplorema</i>	<i>annectens</i>	(Beddard, 1889)		<b>E</b>
<i>Diplorema</i>	<i>bilboi</i>	Blakemore, 2010		<b>E</b>
<i>Diplorema</i>	<i>fallax</i>	(Benham, 1909)		<b>E</b>
<i>Diplorema</i>	<i>haplocystis</i>	(Benham, 1901)		<b>E</b>
<i>Diplorema</i>	<i>micros</i>	(Lee, 1959)		<b>E</b>
<i>Diplorema</i>	<i>montana</i>	(Lee, 1959)		<b>E</b>
<i>Diplorema</i>	<i>pallida</i>	(Lee, 1959)		<b>E</b>
<i>Diplorema</i>	<i>paludosa</i>	(Beddard, 1892)		<b>E</b>
<i>Diplorema</i>	<i>parva</i>	(Lee, 1959)		<b>E</b>
<i>Diplorema</i>	<i>rossi</i>	(Lee, 1959)		<b>E</b>
<b><i>Maoridrilus</i></b>		<b>Michaelsen, 1899</b>		

<i>Maoridrilus</i>	<i>alpinus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>carnosus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>dissimilis</i>	(Beddard, 1885)	<i>Acanthodrilus neglectus</i> Beddard, 1886	<b>E</b>
<i>Maoridrilus</i>	<i>felix felix</i>	Blakemore, 2010		<b>E</b>
<i>Maoridrilus</i>	<i>felix vallis</i>	Blakemore, 2010		<b>E</b>
<i>Maoridrilus</i>	<i>fuscus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>gravus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i> ?	<i>intermedius</i>	Michaelsen, 1923	Species incertae sedis	<b>E</b>
<i>Maoridrilus</i> ?	<i>mauiensis</i>	Benham, 1904	Species incertae sedis	<b>E</b>
<i>Maoridrilus</i>	<i>megacystis</i>	Benham, 1919		<b>E</b>
<i>Maoridrilus</i>	<i>michaelseni</i>	Ude, 1905		<b>E</b>
<i>Maoridrilus</i>	<i>minor</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>modestus</i>	Michaelsen, 1910		<b>E</b>
<i>Maoridrilus</i>	<i>montanus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>nelsoni</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>pallidus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>parkeri</i>	(Beddard, 1895)		<b>E</b>
<i>Maoridrilus</i>	<i>plumbeus</i>	(Beddard, 1895)		<b>E</b>
<i>Maoridrilus</i>	<i>purus</i>	Ude, 1905		<b>E</b>
<i>Maoridrilus</i>	<i>ruber</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>rubicundus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>smithi</i>	(Beddard, 1892)		<b>E</b>
<i>Maoridrilus</i>	<i>suteri ama</i>	Blakemore, 2010		<b>E</b>
<i>Maoridrilus</i>	<i>suteri suteri</i>	Michaelsen, 1922		<b>E</b>
<i>Maoridrilus</i>	<i>tetragonurus</i>	Michaelsen, 1899		<b>E</b>
<i>Maoridrilus</i> ?	<i>thomsoni</i>	Benham, 1919	Species incertae sedis	<b>E</b>
<i>Maoridrilus</i>	<i>transalpinus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>uliginosus</i>	(Hutton, 1877)	<i>Acanthodrilus novaezelandicae</i> Beddard, 1885; <i>Acanthodrilus rosae</i> Beddard, 1889	<b>E</b>
<i>Maoridrilus</i>	<i>ultimus</i>	Lee, 1959		<b>E</b>

<i>Maoridrilus</i>	<i>volutus</i>	Lee, 1959		<b>E</b>
<i>Maoridrilus</i>	<i>wilkini</i>	Lee, 1959		<b>E</b>
<b><i>Microscolex</i></b>		<b>Rosa, 1887</b>		
<i>Microscolex</i>	<i>aucklandicus aucklandicus</i>	(Benham, 1903)		<b>E</b>
<i>Microscolex</i>	<i>aucklandicus bollonsi</i>	(Benham, 1909)	(Possibly synonymous with nominal subspecies)	<b>E</b>
<i>Microscolex</i>	<i>aucklandicus pallidus</i>	(Benham, 1909)	(Possibly synonymous with nominal subspecies)	<b>E</b>
<i>Microscolex</i>	<i>campbellianus</i>	(Benham, 1905)		<b>E</b>
<i>Microscolex</i>	<i>dubius</i>	(Fletcher, 1887)		<b>A</b>
<i>Microscolex</i>	<i>phosphoreus</i>	(Dugès, 1837)	<i>Microscolex novazelandiae</i> Beddard, 1894 (corr. <i>novaezelandiae</i> )	<b>A</b>
<b><i>Neochaeta</i></b>		<b>Lee, 1959</b>		
<i>Neochaeta</i>	<i>forsteri</i>	Lee, 1959		<b>E</b>
<i>Neochaeta</i>	<i>salmoni</i>	Lee, 1959		<b>E</b>
<b><i>Neodrilus</i></b>		<b>Beddard, 1887</b>		
<i>Neodrilus</i>	<i>agilis</i>	Lee, 1949		<b>E</b>
<i>Neodrilus</i>	<i>campestris</i>	(Hutton, 1877)	<i>Neodrilus monocystis</i> Beddard, 1887	<b>E</b>
<i>Neodrilus</i>	<i>dissimilis</i>	Lee, 1959		<b>E</b>
<i>Neodrilus</i>	<i>edwardsi</i>	Lee, 1959		<b>E</b>
<i>Neodrilus</i>	<i>polycystis</i>	Lee, 1959		<b>E</b>
<b><i>Perieodrilus</i></b>		<b>Michaelsen, 1910</b>		
<i>Perieodrilus</i>	<i>lateralis</i>	(Benham, 1903)		<b>E</b>
<i>Perieodrilus</i>	<i>montanus</i>	(Benham, 1903)		<b>E</b>
<i>Perieodrilus</i>	<i>plunketi</i>	(Benham, 1909)		<b>E</b>
<i>Perieodrilus</i>	<i>ricardi</i>	(Benham, 1903)		<b>E</b>
<b><i>Plagiochaeta</i></b>		<b>Benham, 1891</b>		
<i>Plagiochaeta</i>	<i>lineata</i>	(Hutton, 1877)		<b>E</b>
<i>Plagiochaeta</i>	<i>stewartensis</i>	Michaelsen		<b>E</b>
<i>Plagiochaeta</i>	<i>sylvestris</i>	(Hutton, 1877)	<i>Plagiochaeta punctata</i> Benham, 1891	<b>E</b>
<b><i>Rhododrilus</i></b>		<b>Beddard, 1889</b>	<i>Leptodrilus</i> Benham 1909; <i>Kayarmacia</i>	

			Jamieson, 1997.	
<i>Rhododrilus</i>	<i>aduncocystis</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>agathis</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>albidus</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>aquaticus</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>attenuatus</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>benhami</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>besti</i>	Benham, 1904		<b>E</b>
<i>Rhododrilus</i>	<i>cockaynei</i>	Benham, 1905	<i>Rhododrilus cockaynei</i> var. <i>waterfieldi</i> Benham, 1909; (corr. <i>cockaynei</i> ).	<b>E</b>
<i>Rhododrilus</i>	<i>dobsoni</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>edulis</i>	Benham, 1904	Species incertae sedis (meroic?)	<b>E</b>
<i>Rhododrilus</i>	<i>huttoni</i>	(Benham, 1901)		<b>E</b>
<i>Rhododrilus</i>	<i>insularis</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>intermedius</i>	Lee, 1952	Species incertae sedis (meroic?)	<b>E</b>
<i>Rhododrilus</i>	<i>kermadecensis</i>	Benham, 1905	<i>Rhododrilus littoralis</i> Jamieson, 1974	<b>EK</b>
<i>Rhododrilus</i>	<i>leptomerus</i>	Benham, 1905	<i>Leptodrilus magneticus</i> Benham, 1909	<b>E</b>
<i>Rhododrilus</i>	<i>macroseptus</i>	Lee, 1952	Species incertae sedis (meroic?)	<b>E</b>
<i>Rhododrilus</i>	<i>microgaster</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>minimus</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>minutus</i>	Beddard, 1889		<b>E</b>
<i>Rhododrilus</i>	<i>monticola</i>	(Beddard, 1895)	Previous <i>species incertae sedis</i> (gizzard in 8), validated by Lee (1962)	<b>E</b>
<i>Rhododrilus</i>	<i>papaensis</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>parvus</i>	Benham, 1906		<b>E</b>
<i>Rhododrilus</i>	<i>ravus</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>robustus</i>	Lee, 1952		<b>E</b>
<i>Rhododrilus</i>	<i>rosae</i>	Lee, 1959		<b>E</b>
<i>Rhododrilus</i>	<i>sexpapillatus</i>	Dyne, 1980		<b>E</b>
<i>Rhododrilus</i>	<i>similis</i>	Benham, 1906		<b>E</b>
<i>Rhododrilus</i>	<i>subtilis</i>	Lee, 1959		<b>E</b>

<i>Rhododrilus</i>	<i>sutherlandi</i>	Lee, 1952	<b>E</b>
<i>Rhododrilus</i>	<i>tetratheca</i>	Lee, 1959	<b>E</b>
<b><i>Sylvodrilus</i></b>		<b>Lee, 1959</b>	
<i>Sylvodrilus</i>	<i>gravus</i>	Lee, 1959	<b>E</b>
<b>OCTOCHAETIDAE</b>			
<b><i>Deinodrilus</i></b>		<b>Beddard, 1889</b>	<i>Dinodrilus</i> (illegal emend.) Michaelsen, 1900; <i>Conicodrilus</i> Benham, 1945.
<i>Deinodrilus</i>	<i>agilis</i>	Lee, 1952	<b>E</b>
<i>Deinodrilus</i>	<i>benhami</i>	Beddard, 1889	<b>E</b>
<i>Deinodrilus</i>	<i>gorgon</i>	Blakemore, 2010	<b>E</b>
<i>Deinodrilus</i>	<i>gracilis</i>	Ude, 1905	<b>E</b>
<i>Deinodrilus</i>	<i>kanieriensis</i>	(Benham, 1945)	<b>E</b>
<i>Deinodrilus</i>	<i>lateralis</i>	Lee, 1959	<b>E</b>
<i>Deinodrilus</i>	<i>medusa</i>	Blakemore, 2010	<b>E</b>
<i>Deinodrilus</i>	<i>montanus</i>	Lee, 1959	<b>E</b>
<i>Deinodrilus</i>	<i>parvus</i>	Lee, 1959	<b>E</b>
<i>Deinodrilus</i>	<i>suteri</i>	Benham, 1906	<b>E</b>
<b><i>Hoplochaetina</i></b>		<b>Michaelsen, 1920</b>	
<i>Hoplochaetina</i>	<i>durvilleana</i>	(Benham, 1919)	<b>E</b>
<i>Hoplochaetina</i>	<i>pallida</i>	Lee, 1952	<b>E</b>
<i>Hoplochaetina</i>	<i>polycystis</i>	Lee, 1952	<b>E</b>
<i>Hoplochaetina</i>	<i>robusta</i>	Lee, 1952	<b>E</b>
<i>Hoplochaetina</i>	<i>rossii</i>	(Benham, 1903)	<b>E</b>
<i>Hoplochaetina</i>	<i>rubra</i>	Lee, 1959	<b>E</b>
<i>Hoplochaetina</i>	<i>spirilla</i>	Lee, 1959	<b>E</b>
<i>Hoplochaetina</i>	<i>subtilis</i>	Lee, 1959	<b>E</b>
<b><i>Leucodrilus</i></b>		<b>Lee, 1952</b>	
<i>Leucodrilus</i>	<i>digitocystis</i>	Lee, 1952	<b>E</b>
<i>Leucodrilus</i>	<i>disparatus</i>	(Lee, 1952)	<b>E</b>
<i>Leucodrilus</i>	<i>fuscus</i>	Lee, 1952	<b>E</b>
<i>Leucodrilus</i>	<i>robustus</i>	Lee, 1959	<b>E</b>

***Octochaetus*****Beddard, 1893**

*Cryptochaeta* Benham, 1950 [preocc. non *Cryptochetum* Rondani 1876 (Diptera)] placed in synonymy by Lee (1959: 104); *Neodiplotrema* Dyne, 1997.

<i>Octochaetus</i>	<i>antarcticus</i>	(Beddard, 1889)		<b>E</b>
<i>Octochaetus</i>	<i>brucei</i>	Lee, 1952		<b>E</b>
<i>Octochaetus</i>	<i>diememoratio</i>	Blakemore, 2010		<b>E</b>
<i>Octochaetus</i>	<i>huttoni</i>	Beddard, 1892		<b>E</b>
<i>Octochaetus</i>	<i>kapitiensis</i>	Lee, 1959		<b>E</b>
<i>Octochaetus</i>	<i>kenleei</i>	Blakemore, 2010		<b>E</b>
<i>Octochaetus</i> ?	<i>levis</i>	(Hutton, 1877)	Species incertae sedis	<b>E</b>
<i>Octochaetus</i>	<i>michaelseni</i>	Benham, 1904		<b>E</b>
<i>Octochaetus</i> ?	<i>microchaetus</i>	(Benham, 1950)	Type of <i>Cryptochaeta</i> Benham, 1950.	<b>E</b>
			Species incertae sedis	
<i>Octochaetus</i>	<i>multiplus</i>	(Beddard, 1885)	Michaelsen (1900: 319) put <i>thomasi</i> in synonymy; cf. Lee (1959: 115)	<b>E</b>
<i>Octochaetus</i>	<i>pelorus</i>	Lee, 1959		<b>E</b>
<i>Octochaetus</i>	<i>ravus</i>	Lee, 1959		<b>E</b>
<i>Octochaetus</i>	<i>sylvestris</i>	Lee, 1952		<b>E</b>
<i>Octochaetus</i>	<i>thomasi</i>	Beddard, 1893	Sometimes dated "1892".	<b>E</b>
<i>Octochaetus</i>	<i>tricystis</i>	Lee, 1952		<b>E</b>

**MEGASCOLECIDAE*****Amynthas***

<i>Amynthas</i>	<i>corticis</i>	Kinberg, 1867		<b>A</b>
<i>Amynthas</i>		(Kinberg, 1867)		<b>A</b>
<i>Amynthas</i>	<i>gracilis</i>	(Kinberg, 1867)		<b>AK</b>
<i>Amynthas</i>	<i>hupeiensis</i>	(Michaelsen, 1895)		<b>A</b>

***Anisochaeta***

Beddard, 1890

*Trichaeta* Spencer, 1900; *Spenceriella* Michaelsen, 1907; *Gemascolex* Edmonds & Jamieson, 1973; *Pericryptodrilus* Jamieson 1977;

<i>Anisochaeta</i>	<i>animae</i>	(Lee, 1959)	<i>Propheretima</i> Jamieson, 1975.	<b>E</b>
<i>Anisochaeta</i>	<i>laingii</i>	(Benham, 1903)		
<i>Anisochaeta</i>	<i>novaezealandiae</i>	(Lee, 1952)	[Misspelt "novaezealandiae" in Reynolds & Cook, 1979:146].	<b>E</b>
<b><i>Celeriella</i></b>		<b>Gates, 1958</b>		
<i>Celeriella</i>	<i>antarctica</i>	(Baird, 1871)	<i>Diporochaeta shakespeari</i> Benham, 1906.	<b>E</b>
<i>Celeriella</i>	<i>argillae</i>	(Lee, 1959)		<b>E</b>
<i>Celeriella</i>	<i>gigantea</i>	(Benham, 1906)		<b>E</b>
<i>Celeriella</i>	<i>pallida</i>	(Lee, 1959)	Species incertae sedis (prostatae tubuloracemose?).	<b>E</b>
<b><i>Didymogaster</i></b>		<b>Fletcher, 1886</b>		
<i>Didymogaster</i>	<i>sylvatica</i>	Fletcher, 1886		<b>A</b>
<b><i>Diporochaeta</i></b>		<b>Beddard, 1890</b>		
<i>Diporochaeta</i>	<i>aquatica</i>	Benham, 1903		<b>E</b>
<i>Diporochaeta</i>	<i>brachysoma</i>	Benham, 1909		<b>E</b>
<i>Diporochaeta</i>	<i>caswelli</i>	Lee, 1959		<b>E</b>
<i>Diporochaeta</i>	<i>chathamensis</i>	Benham, 1901		<b>E</b>
<i>Diporochaeta</i>	<i>duodecimalis</i>	(Michaelsen, 1923)		<b>E</b>
<i>Diporochaeta</i>	<i>heterochaeta</i>	Benham, 1909		<b>E</b>
<i>Diporochaeta</i>	<i>intermedia</i>	Beddard, 1889	<i>Perichaeta novae-zelandiae</i> Beddard, 1888; <i>Diporochaeta intermedia taipo</i> Jamieson, 1976.	<b>E</b>
<i>Diporochaeta</i>	<i>minima</i>	Lee, 1959		<b>E</b>
<i>Diporochaeta</i>	<i>obtusa</i>	Lee, 1952		<b>E</b>
<i>Diporochaeta</i>	<i>pounamu</i>	Blakemore, 2010		<b>E</b>
<i>Diporochaeta</i>	<i>punctata</i>	Lee, 1959	Misspelt "puctata" in Reynolds & Cook, 1976: 160.	<b>E</b>
<i>Diporochaeta</i>	<i>radula</i>	Blakemore, 2010		<b>E</b>
<b><i>Graliophilus</i></b>		<b>Jamieson, 1971</b>		

<i>Graliophilus</i>	<i>aucklandicus</i>	(Benham, 1909)		<b>E</b>
<i>Graliophilus</i>	<i>parvus</i>	(Lee, 1959)		<b>E</b>
<i>Graliophilus</i>	<i>stewartensis</i>	(Lee, 1959)		<b>E</b>
<b><i>Megascolides</i></b>		<b>McCoy, 1878</b>		
<i>Megascolides</i>	<i>albus</i>	Lee, 1952	(Corr. <i>alba</i> Lee, 1952).	<b>E</b>
<i>Megascolides</i>	<i>fuscus</i>	Lee, 1952		<b>E</b>
<i>Megascolides</i>	<i>irregularis</i>	Lee, 1952		<b>E</b>
<i>Megascolides</i>	<i>neglectus</i>	Cognetti, 1909		<b>E</b>
<i>Megascolides</i>	<i>parvus</i>	Lee, 1952		<b>E</b>
<i>Megascolides</i>	<i>raglani</i>	Lee, 1952		<b>E</b>
<i>Megascolides</i>	<i>reptans</i>	(Ude, 1905)		<b>E</b>
<i>Megascolides</i>	<i>ruber</i>	Lee, 1952		<b>E</b>
<i>Megascolides</i>	<i>rubicundus</i>	Lee, 1959	Misspelt "ribicundus" in Reynolds & Cook, 1976: 165.	<b>E</b>
<i>Megascolides</i>	<i>tasmani</i>	Lee, 1959		<b>E</b>
<i>Megascolides</i>	<i>unipapillatus</i>	(Ude, 1905)		<b>E</b>
<i>Megascolides</i>	<i>viridis</i>	Lee, 1952		<b>E</b>
<b><i>Notoscolex</i></b>				
<i>Notoscolex</i>	<i>equestris</i>	Benham, 1942		<b>E</b>
<i>Notoscolex</i>	<i>esculenta</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>hakeaphilus</i>	Benham, 1949		<b>E</b>
<i>Notoscolex</i>	<i>huttoni</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>kirki</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>maorica</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>mortenseni</i>	(Michaelsen, 1923)		<b>E</b>
<i>Notoscolex</i>	<i>napierensis</i>	Benham, 1941		<b>E</b>
<i>Notoscolex</i>	<i>sapida</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>suteri</i>	(Benham, 1904)		<b>E</b>
<i>Notoscolex</i>	<i>urewerae</i>	(Benham, 1904)		<b>E</b>
<b><i>Perionychella</i></b>		<b>Michaelsen, 1907</b>		
<i>Perionychella</i>	<i>egmonti</i>	(Lee, 1952)		<b>E</b>

<i>Perionychella</i>	<i>helophila</i>	(Benham, 1909)		<b>E</b>
<i>Perionychella</i>	<i>ngakawau</i>	Blakemore, 2010		<b>E</b>
<i>Perionychella</i>	<i>perionychopsis</i>	(Benham, 1909)		<b>E</b>
<i>Perionychella</i>	<i>shoeana</i>	(Cognetti, 1912)		<b>E</b>
<b><i>Pontodrilus</i></b>		<b>Perrier, 1874</b>		
<i>Pontodrilus</i>	<i>lacustris</i>	(Benham, 1903)		<b>E</b>
<i>Pontodrilus</i>	<i>litoralis</i>	(Grube, 1855)	<i>Pontodrilus matushimensis</i> <i>chathamianus</i> Michaelsen, 1899; (for other synonyms, see Blakemore, 2002)	
<b><i>Perionyx</i></b>		<b>Perrier, 1872</b>		
<i>Perionyx</i>	<i>excavatus</i>	Perrier, 1872	<b>New record New Zealand (by RJB).</b>	<b>A</b>
<b><i>Zacharius</i></b>		<b>Blakemore, 1997</b>		
<i>Zacharius</i>	<i>obo</i>	Blakemore, 2010		<b>E</b>
<b>GLOSSOSCOLECIDAE</b>				
<i>Pontoscolex</i>	<i>corethrurus</i>	(Müller, 1857)	Sometimes misdated "1856".	<b>A</b>
<b>LUMBRICIDAE</b>				
<i>Allolobophora</i>	<i>chlorotica</i>	(Savigny, 1826)		<b>A</b>
<i>Allolobophoridella</i>	<i>eiseni</i>	(Levinsen, 1884)		<b>A</b>
<i>Aporrectodea</i>	<i>caliginosa</i>	(Savigny, 1826)		<b>A</b>
<i>Aporrectodea</i>	<i>longa</i>	(Ude, 1885)		<b>A</b>
<i>Aporrectodea</i>	<i>rosea</i>	(Savigny, 1826)		<b>A</b>
<i>Aporrectodea</i>	<i>trapezoides</i>	(Dugès, 1828)		<b>A</b>
<i>Aporrectodea</i>	<i>tuberculata</i>	(Eisen, 1874)		<b>A</b>
<i>Dendrobaena</i>	<i>veneta</i>	(Rosa, 1886)	<b>New record New Zealand (by RJB).</b>	<b>A</b>
<i>Dendrodrilus</i>	<i>rubidus rubidus</i>	(Savigny, 1826)		<b>A</b>
<i>Eisenia</i>	<i>andrei</i>	Bouché, 1972	(Possibly synonymous with <i>E. fetida</i> )	<b>A</b>
<i>Eisenia</i>	<i>fetida</i>	(Savigny, 1826)		<b>A</b>
<i>Eiseniella</i>	<i>tetraedra</i>	(Savigny, 1826)		<b>A</b>
<i>Lumbricus</i>	<i>castaneus</i>	(Savigny, 1826)		<b>A</b>
<i>Lumbricus</i>	<i>rubellus</i>	Hoffmeister, 1843		<b>A</b>
<i>Lumbricus</i>	<i>terrestris</i>	Linnaeus, 1758		<b>A</b>

<i>Octolasion</i>	<i>cyaneum</i>	(Savigny, 1826)		<b>A</b>
<i>Octolasion</i>	<i>tyrtaeum lacteum</i>	(Örley, 1881)		<b>A</b>
<i>Octolasion</i>	<i>tyrtaeum tyrtaeum</i>	(Savigny, 1826)	<b>New record New Zealand (by RJB).</b>	<b>A</b>

\*Code: **A= alien or exotic; E= endemic or native; K= Kermadec Islands.**

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